amateur radio

NOVEMBER, 1972

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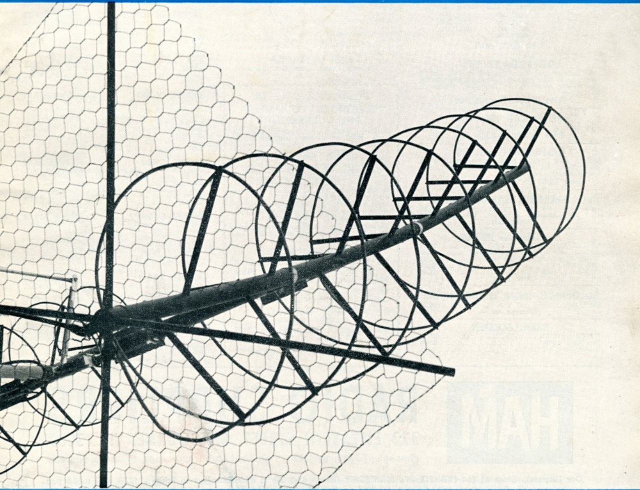

SATELLITE ISSUE

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With internal battery, leads, prods.

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High 100,000 ohm/volt sensitivity on DC. Mirror scale, protected movement. AC volts: 6, 30, 120, 300, 600, 1200 (10K o.p.v.). DC volts: 3, 12, 60, 120, 300, 600, 1200 (100,000 o.p.v.). DC current: 12 uA., 6 mA., 60 mA., 300 mA., 12 amps. Resistance (ohms): 2K, 200K, 20M, 200M. dB. scale: minus 20 to plus 63 dB. Audio output (volts AC): 6, 30, 120, 300, 500 1200. Battery: Internal. Approx. size: 7½ x 5½ x 2¾ inches.

MODEL OL-64D — **Price $19.75**

20,000 ohms per volt. DC volts: 0.025, 1, 10, 50, 250, 500, 1000 (at 20K o.p.v.), 5000 (at 10K o.p.v.). AC volts: 10, 50, 250, 1000 (at 8K o.p.v.). DC current: 50 uA., 1 mA., 50 mA., 500 mA., 10 amps. Resistance (ohms): 4K, 400K, 4M, 40 megohms. dB scale: minus 20 to plus 36 dB. Capacitance: 250 pF. to 0.02 uF. Inductance: 0-5000 Henries. Size: 5¾ x 4¼ x 1¾ inches.

MODEL C1000 — **Price $6.95**

This is the ideal low-cost pocket meter. AC volts: 10, 50, 250, 1000 (1000 o.p.v.). DC volts: 10, 50, 250, 1000 (1000 o.p.v.). DC current: 1 mA., 100 mA. Resistance (ohms): 150K. dB. scale: minus 10 to plus 22 dB. Dimensions: 4¾ x 3¼ x 1¼ inches.

MODEL CT-500/P — **Price $16.75**

Popular, medium-size, mirror scale, over-loaded protected. AC volts: 10, 50, 250, 500, 1000 (10K o.p.v.). DC volts: 2.5, 10, 50, 250, 500, 5000. DC current: 50 uA., 5 mA., 50 mA., 500 mA. Resistance (ohms): 12K, 120K, 1.2M, 12M. dB. scale: minus 20 to plus 62 dB. Approx. size: 5½ x 3½ x 1¾ inches.

MODEL A-10/P — **Price $55.00**

Giant 6½ inch meter. In-built signal injector, overload protected. AC volts: 2.5, 10, 50, 250, 500, 1000 (10K o.p.v.). DC volts: 0.5, 2.5, 10, 50, 250, 500, 1000 (30K o.p.v.), 5000 (10K o.p.v.). DC current: 50 uA., 1 mA., 50 mA., 250 mA., 1 amp., 10 amps. AC current: 1 amp., 10 amps. Resistance (ohms): 10K, 100K, 1M, 100M. dB. scale: minus 20 to plus 62 dB. Signal injector: Blocking oscillator circuit with a 2SA102 transistor. Approx. size: 6½ x 7¼ x 3¾ inches.

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amateur radio

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COVER

Portion of the twin helix 2 metre satellite tracking array used by VK3ABP. The helixes are 12 ft. long of eight turns of 3/8 in. aluminium tubing, and the array is remotely controllable in elevation and azimuth.

Photo: VK3YAZ and VK3ZU.

QSP

At page 15 of the August issue of "A.R." we reported on the results of the special Conference held at Albury on 8th and 9th July, 1972, to consider the possible alteration of existing repeater and simplex channels in the 2 metre band.

The Conference arose from proposals put forward by the Victorian Division with a view to leaving the allocation 144 to 146 MHz. clear for Satellite operation, that being the segment allocated for that purpose as a result of the 1971 W.R.A.C. on Space Communications.

The recommendations of the Conference were circulated as a postal vote for Federal Council. The Executive delayed the circulation of this postal vote for some time to enable full discussion of the proposals to take place at Divisional and other meetings. In fact the proposals have generated some intense debate and many Amateurs interested in this area of operation have formed extremely strong views either for or against the proposals to alter the existing channels.

It is interesting to record that in a matter of days before the circulation of the postal vote the Federal Communications Commission released a report and order prohibiting terrestrial repeaters in the U.S.A. between 144 and 146 MHz. to preserve for satellite communications the world-wide band from 144 to 146 MHz. (the band 144-148 MHz. is allocated to the Amateur Service **only** in Regions 2 and 3).

It is also interesting to note that the v.h.f. repeater group in the Southern California area, at a meeting held on 9th September, adopted a frequency allocation plan in that area which will require the voluntary shifting of frequencies by more than 50 repeaters. I do not offer this information in support of the proposals circulated, but draw your attention to them as evidence of a global concern for the problem placed before the Federal Council by the postal vote for their consideration.

The Federal Councillor of the New South Wales Division, Mr. Don Miller, VK2GN, has given notice in accordance with Article 44 of the Institute's Articles of Association that he requires the matters the subject of this postal poll to be held over for determination at the next Federal Convention. The right to take this step in relation to a postal poll of the Federal Council is given to each Federal Councillor. The object of this Article is to provide a means of protection against hasty decisions on important matters without the opportunity for adequate discussion.

Accordingly, the Federal Council is unable to determine the matter by a postal poll and the Institute will not adopt at this time, nor can it adopt prior to the Federal Convention any policy seeking the change of the existing repeater allocations. Whether the Council will decide to preserve the status quo or adopt a new policy will be decided by the Federal Council at the next Federal Convention.

MICHAEL J. OWEN, VK3KI,
Federal President, W.I.A.

1973 CALL BOOK

All members of the Publications Committee have been working very hard during the past few months to improve "A.R.," and with the able help of the Contributing Editors, Drafting Assistants, and Publishing Associates, we feel that, within the stringent economic limitations imposed upon us, we are gradually improving the presentation and content of the magazine. And, most important, the financial situation is looking better all the time.

One of the duties of the Publications Committee is the production of the Call Book. The preliminary planning and costing of the 1973 Call Book has been completed, and I am sure that all Amateurs will be pleased with the improved format, the additional information, and the cost of the finished article.

However, the most important part of the Call Book, the station listings, is causing considerable concern.

At the closing date for this Call Book, 31st December, 1972, the P.M.G. Dept. will provide us with the official lists of all Amateur Stations under the control of the Australian administration. We will then check this against our own index systems, which are continually updated from their monthly lists, as well as from written forms of advice we receive from Amateurs themselves.

So, you say, what is the problem?

Simply this. A rough check of our index system against the mailing list for "A.R." shows that a large number of Amateurs are receiving the magazine at an address different from their station address.

Does this mean that they now have a separate postal address from their station address, or does it mean that the station address has also changed? We don't know!

Unless the change-of-address advice received by us **specifically states that the new address is also the new station address**, and is not just a new address for "A.R.," we are unable either to alter the Call Book index or to advise the P.M.G.

If your mailing address, as shown on your "A.R." wrapper, is NOT also your station address, please let us know as soon as possible and give us your full station address. This is needed only if your 1971 Call Book details have changed or are incorrect.

Are you blameless of this type of change-of-address advice?

If your address was incorrect in the last Call Book, or has changed since that time, and you are not absolutely sure that you advised both the W.I.A. and the P.M.G. in the correct manner, please do something about it NOW.

If you want to be correctly listed in the 1973 Call Book, you MUST advise us **at once** of any amendments, and your advice MUST reach us before 31st December, 1972. We will then advise the P.M.G. Dept. of the alteration, and the official lists as printed in the 1973 Call Book should be as accurate as you can make them.

—Call Book Sub-Committee.

OTHER SERVICES

The charges for obtaining television programmes via satellite (Intelsat) remain at $850 for the first ten minutes and $40 for each additional minute. (Aust. Br. Control Board, 24th Annual Report.)

CALL SIGN BLOCKS

The I.T.U. has allocated to Oman (Sultanate) the call sign block A4A to A4Z, and to Bangladesh the block S2A to S3Z. (Reg. 1 News.)

ITALIAN LICENSING

In Italy it appears there are four classes of licence available, but mobile operations are not permitted. The class 1 licence allows up to 75w. input, class 2 up to 150w., class 3 up to 350w. and a new technician's licence (theory exam. only) for 10w. input on vh.f. and u.h.f. bands only. (I.A.R.U. Reg. 1 News.)

TRANSISTORS AND VALVES

The percentage of total usage of transistors and valves in 1967 was shown as 94% valves, 5% transistors and 1% ICs. For 1972 these were quoted as 30%, 49% and 21% respectively. By 1974 the percentages are expected to be 5%, 35% and 60% respectively. (W6LS Bulletin.)

SWITZERLAND

Licensing authorities are now prepared to allow repeaters having input and output frequencies in the 2 metre band. It is not expected that many 2 metre repeaters will be installed, since five repeaters are now operating in the 70 cm. band, giving excellent results. The latter band proves to be superior for mobile work in cities and mountainous areas. (I.A.R.U. Reg. 1 News, Aug. '72.)

MARCO

Marco means "Medical Amateur Radio Council". In a recent letter, JA0BXP/1, C/o. Nomura, 2-21-9 Ogikubo, Suginami-ku, Tokyo 167, writes that he is Marco correspondent in Japan but is hampered by the absence of an Asia-Oceania net to prepare for any medical emergencies. If you are a Radio Amateur Medical Practitioner you might care to write to him direct to set up skeds.

PORTABLE AND MOBILE OPERATIONS

A recent letter from the Director-General P.M.G's Department Radio Branch (RB1/17/46) clarifies the meaning of paragraphs 90 and 91 in the Handbook. The letter states, inter alia, "Portable or mobile operation referred to in these paragraphs, including the 'five consecutive days' when no approval is required, means absences of a licensed Amateur from his fixed station address during which he is in possession of portable or mobile equipment capable of being used in the Amateur Service".

In further elucidation, it has been ascertained that the key to the situation is "absence from the fixed station address".

If you do NOT go away from your fixed station address for more than five days at any one time you can, of course, work portable or mobile without special approval. However, if you are away from your fixed station address for more than five days at any one time and you take with you, or use, portable or mobile equipment in that period you must obtain special approval to operate portable or mobile even if only for a few minutes.

BARS

If your signal puts some across your neighbour's t.v. you could go out into too many, come out singing a few, and end up behind some—even if you are a sheep farmer.

SATELLITE TRACK CALCULATOR

P. D. FRITH,* VK7PF

● In this article VK7PF describes what is possibly one of the simplest ways yet devised of making orbital predictions for a satellite such as Amsat Oscar-C. He also gives some sound practical advice on antenna pointing while attempting communication through the satellite translator.

This visual method plots the path across the earth of a satellite and from this determines:

(1) In what direction will it first be heard and at what time (acquisition of signal, or a.o.s.).

(2) The bearing, time and elevation at closest approach (t.c.a.).

(3) The loss of signal (l.o.s.), direction and time.

For communication purposes it is required to know areas of possible contacts. These can be found by using overlays for the particular areas and establishing whether there is a common overlap period when the satellite is within range of both stations.

SOME TERMS

Before going into details, some terms used in tracking satellites will be given and explained. When the first Oscars were tracked I had difficulty in finding a suitable text to explain in just the right amount of detail the mechanism of how and why a satellite orbits where it does and Ref. 1 is to be recommended as that text.

Orbit.—A satellite is in orbit when it revolves around the earth in a plane which passes through the earth's centre. This means that it has to spend time in both the north and south hemispheres. It is not possible to orbit around say 40°S latitude only.

Orbit Number.—The start of an orbit is said to be when a satellite passes over the equator on a north bound track (ascending node) and the number of the orbit changes at that time. It will be seen from the calculator that it also passes over the equator southbound (descending node) approximately 180° further west.

Inclination.—This is the angle the plane of revolution makes with the equator at the start of an orbit with east as reference. For AO-C this will be 102°, which is the angle required for the chosen height to cancel the influences that would move the daily viewing time away from the chosen 9 o'clock local sun time.

Progression of Tracks.—The plane of the orbit in which the satellite revolves can be regarded as fixed with the earth rotating beneath. This means that successive equator crossings in the same direction will be further to the west and because of this the longitude scale on the equator is marked in degrees west only.

Period.—The time of one revolution. For earlier Oscars this varied but the changes will be of no consequence for AO-C.

Predictions.—These are usually given as orbit numbers, the time of the start of this orbit (as it crosses the equator northbound) and the west longitude of this crossing.

THE CALCULATOR

This takes the form of a polar map, that is, a great circle map with the south pole as centre. Two sample tracks are shown on Fig. 1, one south-bound east of Australia and the other north-bound in the same area. The first would be around 8 a.m. and the other around 9 p.m. The tracks are actually great circle paths corrected for the earth's rotation as the satellite moves along them. The north-bound track crosses the equator south-bound at 006.5°W, passes to the east of the pole and northwards to cross the equator at 200.9°W (006.5 + 180 + 14.4) and into the next orbit.

The south-bound track crosses the equator seven orbits later at 207.5°W, passes to the west of the pole and then north-wards to cross the equator at 41.9°W (207.5 + 180 + 14.4 — 360). The earth rotates 14.4° during half an orbit or 28.8° for a full orbit of AO-C (115 min. period).

The next N-S crossing will be at 236.3°W.

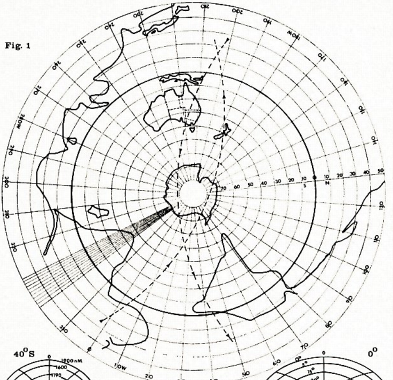
Shown in Fig. 2 are two sample range diagrams which have to be used for the particular latitude of interest. The ones supplied with the tracking kit, being made available, will be for most latitudes and be on transparent paper.

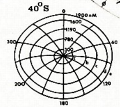
USING THE CALCULATOR

Select the range ring for your latitude and fix it over the map with the centre at your location, or better still, copy it onto the map to leave the transparency free for use at other locations. Fix the map onto a baseboard of heavy cardboard or other suitable material and the AO-C track onto a piece of perspex. Pivot by some means the perspex with the indicated south pole at the south pole of the map. Now you can do a trial run of a typical day's

(continued on page 12)

Fig. 1





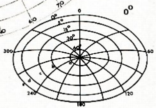


Fig. 2

* 181 Punchbowl Road, Launceston, Tas., 7250.

AO-C 2 METRE TO 10 METRE REPEATER

G. N. LONG, VK3YDB*
Chairman, Project Australis Group

INTRODUCTION

This article is intended to deal with the operation and design of the Amsat 2 metre to 10 metre linear repeater (translator or transponder).

As an insight into its development here is a short history of the device:

(a) Designed by Carl Meinzer, DJ-4ZC, in late 1970. The first prototype was built in the autumn of 1971. (This is the one now here in Australia.)

(b) A second prototype was built in the Spring of 1971 by Mr. P. Klein, K3JTE.

(c) The flight model for AO-C was built in 1972 by Jan King, Perry Klein and other members of the Amsat organisation.

The launch of the AO-C will bring to the Amateurs of the world a means to find some answers to complex questions about propagation, orbital geometry, and electronic reliability. This is the first satellite in the history of Amateur Radio which contains its own primary power generating source, and it will therefore be a long life system.

It is felt that if the system is "go" ten minutes after launch, then it will work for a year, thus giving us Amateurs an invaluable tool with which to demonstrate to various Administrations around the world that Amateur operators are a valuable asset, not a liability as presently thought by some Administrations.

This satellite has the following uses:

(a) Education—by Y.R.C.S., school clubs and universities.

(b) To be available for scientific research by people such as moonbounce groups, C.S.I.R.O., P.M.G. if they so desire—and by medical groups, interested in remote medical sensing.

(c) For outback communication, in Central Australia, as an example.

(d) Further development of small low-cost ground terminals.

These are all great hopes to be fulfilled. The Australian Amateur has done much to help this and, we hope, also the future satellites. To this end we feel that all Amateurs should make maximum use of the **bird.**

Now for a technical description as taken from the latest Amsat Newsletter (September 1972).

THE REPEATER DESIGN

The repeater uses a 2N3478 r.f. transistor as a two metre pre-amplifier and another 2N3478 as the first mixer to mix the two metre received signal down to 39.1 MHz. A 35.61625 MHz. crystal oscillator output is multiplied by three to 106.84875 MHz. and is mixed with the amplified two metre signal to provide this 39.1 MHz. first i.f. frequency. The signal is then fed to a 2N918 second mixer, which uses the 35.61625 MHz. crystal oscillator a second time to mix down to a second i.f. frequency of 3.485 MHz., providing a gain of approximately 20 dB. in the process.

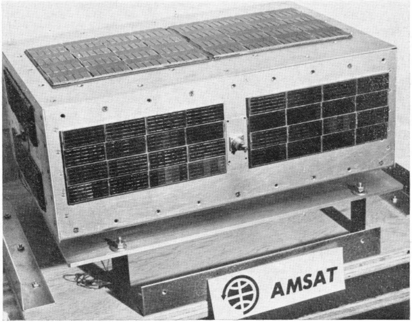
The 3.485 MHz. i.f. signal is then amplified approximately 35 dB. in a single BF167 i.f. amplifier stage, after which it is up-converted to a frequency of 29.5 MHz. in a 2N918 balanced mixer, using a 2N918 crystal local oscillator operating at 26.015 MHz. The balanced mixer achieves a gain of nearly 25 dB., and the signal level at this point is of the order of one milliwatt at 29.5 MHz. The signal is then amplified to a maximum of about 1 to 1.3 watts output using a 2N3866 driver and 2N3375 final amplifier. A.g.c. voltage is developed in a three-transistor a.g.c. amplifier, which senses the emitter current of the final amplifier and controls the gain of the BF167 i.f. amplifier.

The repeater also contains a beacon oscillator which operates at 29.45 MHz., the same frequency used by the last satellite, Australis-Oscar 5. The beacon signal is injected at the input to the driver stage, and the beacon is keyed by the Morse code telemetry encoder or the code-store message storage unit, which are selected alternately at approximately 14 to 15-minute intervals by a clock timer device in the satellite.

USING THE REPEATER

The repeater is designed for linear operation and is capable of handling most forms of narrowband modulation, s.s.b., c.w., a.m., f.m., r.t.t.y. and s.s.t.v. S.s.b. and c.w. are recommended primary modes of operation and make most efficient use of the repeater because a number of users can operate simultaneously, each taking different proportions of the repeater's power capability at a particular instant of time. Therefore, a higher average power level is available to each user since not all c.w. users are key-down at any given instant, nor are all sideband stations talking up to full power at any one moment. A.m., f.m. and r.t.t.y. do not have this characteristic. Thus, stations employing these modes will each expend the available repeater power at all times, even when no intelligence is being transmitted.

To facilitate the most efficient operation of the repeater, all users are strongly urged to continuously monitor their own downlink signals. This is an operating technique previously rarely available to Amateurs, but which enables each user to hear his own signal from the satellite as others hear it. It requires simply that a separate receiver and antenna be available for receiving one's own downlink signal on ten meters, while transmitting simultaneously on the two metre uplink band.



Photograph of the Amsat Oscar-C (Oscar 6) satellite package, courtesy of Dr. Perry Klein, K3JTE.

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Such operation makes possible perfect break-in QSOs and roundtables, particularly on s.s.b., permitting full duplex operation.

Unlike other forms of Amateur communications, satellite communications with downlink self-monitoring permits each user to observe how the DX hears his signal, and he can then adjust his power and frequency to compensate for the satellite's distance and Doppler frequency shift. This is most readily done by observing the satellite's beacon signal level on 29.45 MHz. and adjusting the power of the ground transmitter so that the repeated signal from the satellite appears to be the same level, either as read on an S meter or as determined aurally. If the transmitter is v.f.o. controlled, its frequency should be constantly adjusted by the operator while transmitting to keep the apparent downlink frequency constant in the presence of changing Doppler shift, which can be as much as ±4.5 kHz. for an overhead pass.

Spotting one's own downlink carrier is not always easy through the satellite repeater, and it is quite difficult to zero beat another station without careful dial calibration. One excellent method of getting a "frequency spotter" is to obtain a two metre converter having either a 10 or 20 metre output and use it as a satellite repeater simulator in the shack. If the converter uses a 38.666 or 43.333 MHz. crystal, replacing it with a 38.817 MHz. crystal will convert locally generated two metre signals in the 145.9 to 146.0 MHz. uplink band to the correct frequency in the 29.45 to 29.55 MHz. downlink band, so that spotting and zero beating can be accomplished without the signals leaving the shack.

Because of Doppler shifts up to ±4.5 kHz. which will occur when using the actual satellite repeater, the spotter's frequency will be off by the amount of the Doppler shift. This can easily be corrected for by setting the transmitter frequency several kHz. **higher** than the spotted frequency near the beginning of a pass, or several kHz. **lower** than the spotted frequency near the end of a pass.

OPERATING PROCEDURE

The procedure recommended for operating with the Oscar two-to-ten metre repeater is as follows:

(1) When the satellite comes within range, begin listening for the Morse code beacon signal on 29.45 MHz. Be sure to note the signal strength of the beacon signal. Since the beacon is A1 emission, use your b.f.o. to receive it.

(2) Once you have located the beacon on 29.45 MHz., tune up the band and begin looking for signals from the repeater in the 29.45 to 29.55 MHz. range.

(3) When you are ready to transmit, choose a frequency within the 145.90 to 146.00 MHz. uplink band and send a test signal, preferably a string of dots, on this frequency (f_2). Listen for your own signal re-transmitted from the satellite on the corresponding ten metre frequency (f_{10}), found from the formula:

$$f_{10} = f_2 - 116.45 \text{ MHz.} \pm f_{\text{DOPPLER}}$$

where f_{DOPPLER} = +4.5 kHz. near the beginning of an overhead pass.
= 0 kHz. at the middle of the pass.
= —4.5 kHz. near the end of an overhead pass.

For example, a signal transmitted on 145.92 MHz. will be re-transmitted on 29.47 MHz. ±Doppler. This is where you should listen for your signal. If you can hear your own signal, you can be sure that others can hear your signal as well.

(4) Adjust your transmitter power so that on s.s.b. voice peaks or with a slow string of dots the repeated signal is approximately equal to the beacon signal level. This will assure that you take the correct share of the repeater power without overloading the repeater and running down the satellite's battery unnecessarily. Keep in mind that the power will be divided among all stations in the passband. An overly strong station will prevent other Amateurs from simultaneously using the repeater if he does not reduce his power. He will also reduce the overall repeater gain, through a.g.c. action, so that he will not be able to hear weaker stations who may be trying to call him. If you do not have a convenient method for directly controlling your power output, an alternative technique is to aim your antenna away from the satellite.

If you intend to operate with high power or use a large antenna array such that the transmitter output multiplied by the antenna gain is above 80 to 100 watts effective radiated power, then it is suggested that you operate slightly off from the regular passband of 145.90 to 146.00 MHz. The repeater has an "extended passband" feature in its design, that is the —10 dB. response is ±120 kHz. from the centre frequency (the passband is 240 kHz. wide at the 10 dB. down points). Therefore, if higher power stations will transmit between 145.83 and 145.89 MHz. or from 146.01 to 146.07 MHz., their signals will be compensated for by the roll-off of the repeater response, and they will not take more than the correct portion of the repeater power.

One benefit for doing this is simply a reduction in QRM, since only high power stations can operate through the repeater on these extended frequency segments. Low power stations cannot easily overcome the additional attenuation of the passband roll-off and should operate in the normal repeater passband of 145.90 to 146.00 MHz.

SUMMARY

In summary, listed below are the basic operating characteristics of the AO-C two-to-ten metre linear repeater:

Input frequency range: 145.90 to 146.00 MHz. for normal operation. 145.83 to 146.07 MHz. for extended passband operation.

Output frequency range: 29.45 to 29.55 MHz. for normal operation. 29.38 to 29.62 MHz. for extended passband operation. Passband is **non-inverting** (i.e. upper sideband remains upper sideband and vice versa).

Beacon frequency: 29.45 MHz. (same as Australis-Oscar 5).

Beacon modulation: Morse code (A1 emission).

Repeater bandwidth: 100 kHz. flat; 120 kHz. at 3 dB. down points; 150 kHz at 6 dB. down points; 240 kHz. at 10 dB. down points.

Operating modes: S.s.b. and c.w. are recommended; a.m., r.t.t.y. and s.s.t.v. can also be used but with less efficiency. F.m. is **not** recommended.

Repeater power output: 1 to 1.3 watts c.w. into a half-wave dipole.

Input sensitivity: Approximately —100 dBm. (2 microvolts/m) for full output.

Ground power required: 80 to 100 watts of effective radiated power produces full output from the repeater at a maximum range of 2,000 miles. (An 8 to 10 watt transmitter and 10 dB. of antenna gain, or 80 watt transmitter and omnidirectional antenna should be adequate.)

Intermodulation: 20 dB. down.

A.g.c.: Up to 26 dB. gain reduction; 0.1 second attack time; 2.2 second release time. Designed for highest efficiency with s.s.b.

Ground receiver required: Better than ½ microvolt/m sensitivity for 10 dB. (S+N)/N on 10 metres should be adequate. Dipole antenna can be used, but beam is preferable. ●

THE AMSAT OSCAR-C COMMAND SYSTEM

PETER R. HAMMER, VK3ZPI*

● The author has been involved, as a member of the Australis satellite design group, in the development of command systems for the Amsat Oscar B and C satellites. He discusses here the requirements to be met by a command system and some of the techniques employed in these satellites.

There are several requirements which a command system for a satellite should meet. Firstly, it is necessary to have a sufficiently large number of commands so that the various sub-systems on the spacecraft can be adequately controlled. Secondly, the command system must be secure. This means that the presence of noise and interference at the input of the command decoder must not be decoded as a command. Thirdly, the power consumption of the command decoder must be as low as possible, consistent with the previous requirements. Fourthly, the weight of the command decoder must be as small as possible.

The reason for the last two requirements is that, as the spacecraft weight and power budget are limited, it is desirable that the support systems such as command and telemetry involve as little power and weight as possible so as to leave the maximum amount of power and weight for the main experiments (in this case the 2-10 metre translator and 435 MHz. beacon).

Finally, the command decoder must perform reliably for one year in the harsh environment of space as well as surviving the acceleration and vibration caused by the launch vehicle.

We shall now consider two possible command systems.

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(a) THE FULLY PARALLEL COMMAND SYSTEM

This decoder system is illustrated in Fig. 1. Here we assign each command channel a unique audio tone. When this tone is detected by the decoder, at the decoder input, the appropriate switch at the decoder output is operated. The presence of noise at the decoder input could be interpreted as an erroneous command. To decrease the likelihood of this occurring, we use a separate, unique audio tone, transmitted at the same time as the command tone, to operate an enable gate. Unless this enable tone is present the enable gate is not activated and the decoded command will not be passed through to the output switches.

The decoder scheme described above is very simple and reasonably secure against noise and interference. (Further improvements in this regard can be made by adding additional enable tone systems in parallel with the single one mentioned above.)

The main disadvantage of the fully parallel decoder scheme is that each command needs its own unique tone filter; thus if many command channels are desired the resulting number of filters becomes excessive. The main advantage of the decoder is its inherent redundancy. Provided that the enable channel does not fail, then the failure of one component will only result in the loss of one command. (The enable channel can easily be made redundant, without greatly increasing the weight or the power drain, by duplication of components which are likely to fail.)

(b) THE SERIAL COMMAND SYSTEM

This decoder system is illustrated in Fig. 2. Here we have represented each command by a unique binary word. We transmit the resulting command word in a serial fashion, one bit at a time, and re-assemble the word in the decoder. A decoding matrix in the decoder then decides which command was sent. The decoder for this com-

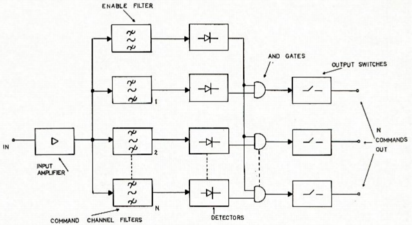

FIG. 1 A BLOCK DIAGRAM OF A FULLY PARALLEL COMMAND SYSTEM

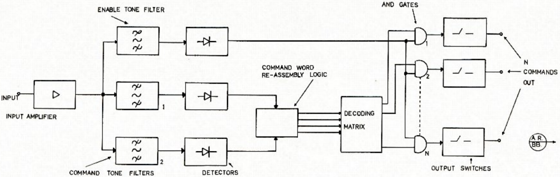

FIG. 2 — A BLOCK DIAGRAM OF A SERIAL COMMAND SYSTEM

mand scheme is thus very similar to a 2-channel parallel decoder; we have replaced the parallel transmission of a large set of possible tones by the serial transmission of a string of two possible tones. (An enable tone can still be used to prevent spurious signals from triggering the decoder.)

In order to correctly re-assemble the bits of the command word it is necessary to have additional information relating to the length of time each bit is sent. This can either be predetermined by the design of the decoder or can be transmitted together with the command word, using a separate timing channel.

The main disadvantage of this decoding scheme is that it is more susceptible to component failure, unless redundancy is designed into each section of the decoder.

It is this latter scheme which has been used for the AO-C spacecraft.

Having decided on the form of the command scheme, we now have to consider how to implement it. Here we are guided by the requirements listed earlier.

The heaviest parts of the decoder are the tone decoding filters. It is possible to use active filters rather than passive filters, but there are two major reasons for not doing this. Firstly, active filters require many more components than passive filters to achieve the same performance and, secondly, the cost and power requirements of the large number of operational amplifiers required is excessive compared to the cost of high quality inductors.

The supply current needed for the analogue portions of the decoder can be minimised by using lower power operational amplifiers and by operating all transistors at very low collector currents. The digital integrated circuits used in the decoder are the only other source of power drain. To minimise this power drain complementary metal-oxide-silicon (COS/MOS) integrated circuits are used. The COS/MOS logic family is based on the use of two series FETs, one P-channel and one N-channel, as shown by the inverter of Fig. 3. As the gates of the two FETs are tied together, only one FET is on at any one time and thus the quiescent d.c. power drain is due to leakage current through the two series channels. In addition, the output state of the gate is a low impedance at all times and thus the noise immunity of the logic family is very high.

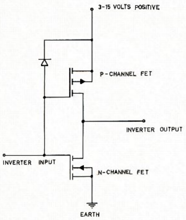

FIG. 3- A COS/MOS INVERTER SCHEMATIC.

Fig. 4 shows the two circuit boards which comprise the complete 21-channel command decoder for AO-C. (The blank spaces in one board are for additional integrated circuits which can be inserted to give the 35-channel command system intended for AO-B.)

The reliability of the command decoder is greatly determined by the components used and by the construction method. The decoder is built on fibre-glass printed circuit boards which have been solder-coated. Solder coating is preferable to gold plating as the lead in solder forms a brittle amalgam with gold and this can result in a dry joint developing after a period of time. Dry joints can best be eliminated by using the correct solder (a 63% tin 37% lead composition solder with a non corrosive resin core) and a constant temperature soldering iron. To prevent damage of the decoder during the high vibration and acceleration experienced during launch most components are mounted hard down on the circuit boards. As this is not always possible, the decoder will need to be potted in polyurethane foam.

As can be seen in Fig. 4, all the digital integrated circuits carry a unique serial number. This is because **they have all been tested by the manufacturer to full military specifications.** The rest of the components used in the decoder are all manufactured to military specifications and have been qualified by N.A.S.A. for use in space.

Having designed the command system, we are now in a position to allocate command channel assignments. To protect the system against component failure it is desirable that any redundant commands have as few circuit components common to the primary command electronics as possible. The final command channel assignments for AO-C are listed below.

LIST OF COMMAND FUNCTIONS FOR AO-C

1. 2 mx/10 mx translator on.
2. 2 mx/10 mx translator off.
3. 435 MHz. beacon transmitter on.
4. 435 MHz. beacon transmitter off.
5. Code store—run mode.
6. Code store—load mode.
7. Morse code telemetry encoder—high bite rate (20 w.p.m.).
8. Morse code telemetry encoder—low bit rate (10 w.p.m.).
9. Translator a.g.c. loop enabled.

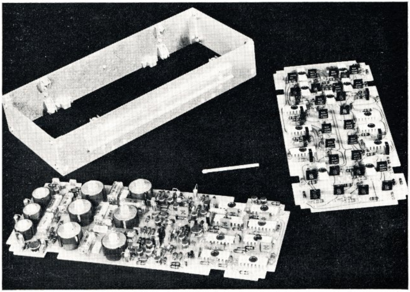

Fig. 4.—A photograph of the AO-C Command Decoder. The photograph was taken before all the interboard wiring was installed. The module housing is shown at the back of the photograph.

10. Translator a.g.c. loop disabled.
11. Command code store to modulate 435 MHz. beacon.
12. Command morse code telemetry encoder to modulate 435 MHz. beacon.
13. Command code store to modulate translator beacon.
14. Command morse code telemetry to modulate translator beacon.
15. Disable commands 13 and 14/enable clock sequence (switches between code store and telemetry once every 15 minutes).
16. Enable command 13 or 14 (whichever was last commanded)/disable clock sequence.
17. Reset clock.
18. 2 mx/10 mx translator on (redundant).
19. 2 mx/10 mx translator off (redundant).
20. 435 MHz. beacon transmitter on (redundant).
21. 435 MHz. beacon transmitter off (redundant). ●

THE AMSAT OSCAR-C TELEMETRY SYSTEM

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Chairman, Project Australis Group

● The purpose of this article is to explain some of the characteristics of the American 24-channel c.w. telemetry system.

The satellite AO-C will carry the following radio and pulse equipment:

(a) Two metre to ten metre translator.
(b) Australis 21-channel command system.
(c) The American c.w. 24-channel telemetry system.
(d) The American code-store system.

This is the first time that this system is being flown on any satellite and its results will be closely examined to see how it compares with the Australis r.t.t.y. telemetry system which is due to fly in the AO-B satellite.

At this stage it should be made clear that the telemetry is purely for housekeeping. It is not intended that the Amateur population should decode the information and send it in. For this satellite this is unnecessary and will cause confusion; i.e. my postman will get very upset!

The telemetry from the satellite will be transmitted in a three-figure code, in which the first number relates to the channel number and is therefore disregarded as far as actual information is concerned.

For example, I will now quote from the Amsat Newsletters for March and June 1972:

SAMPLE TELEMETRY FRAME
(Simulating AO-C Flight Data)

HI	153	132	102	141	
	202	235	200	263	
	352	380	368	355	
	457	452	453	458	
	558	524	530	500	
	633	600	687	650	HI

Using the above data one can answer the following questions (remember to drop the most significant digit which is used for data line identification and is not part of the telemetered value):

1. What is the approximate spacecraft attitude relative to the sun line? Which faces are being illuminated?
2. What is the total power being generated by the solar arrays at the instant the measurement was made?
3. Is the spacecraft running on a positive power budget at the time the measurement was made? (i.e. is the battery being charged or discharged?)
4. What is the state of charge of the battery? This is a function of the battery voltage (unregulated bus voltage).
5. What is the change of temperature (thermal gradient) across the spacecraft?
6. Is the temperature of the power amplifier transistor running at a temperature very close to that of the spacecraft baseplate? (This will influence the p.a. efficiency.)
7. What is the translator usage at the time of the measurement? Is the activity high or low?
8. At what efficiency is the translator power amplifier running? (The p.a. runs from the 24v. unregulated bus.)
9. What is the status of the 435 MHz. beacon?
10. Does the telemetry encoder appear to be in calibration?

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If you have bothered to work out the telemetry values of the sample telemetry frame, using the calibration data, you should have reached the following conclusions:

Channel	Telemetered Value (Counts)	Parameter	Value
1*	53	I_T	265 mA.
2	32	I_{+X}	32 mA.
3	02	I_{+Y}	4 mA.
4	41	I_{+Z}	164 mA.
5	02	I_{-X}	2 mA.
6	35	I_{-Y}	70 mA.
7	00	I_{-Z}	0 mA.
8	63	I_{BAT}	+130 mA.
9	52	V_{BUS}	24.2 V.
10	80	$V_{\frac{1}{2}BAT}$	12.0 V.
11	68	V_{SR}	10.2 V.
12	55	T_{BAT}	15.0°C.
13	57	T_{BP}	12.0°C.
14	52	T_{PA}	19.6°C.
15	53	T_{+X}	17.8°C.
16	58	T_{+Y}	10.5°C.
17	58	T_{+Z}	10.5°C.
18	24	I_{PA}	120 mA.
19	30	V_{TSR}	9.0 V.
20	00	Spare	——
21	33	P_{OUT}	1.09 W.
22	00	P_{OUT}	0.00 W.
23	87	V_{AGC}	2.62 V.
24	50	Cal.	50 counts

* Corrected.

Telemetry values associated with the solar arrays and the spacecraft battery should be checked first since they are the most critical values for maintaining the spacecraft. Problems in the power system obviously affect all of the operating systems. The current available from the solar arrays is used either to charge the battery or is delivered to the loads within the spacecraft. Of these loads the translator and the 435 MHz. beacon draw most of the current. We can thus write:

$$I_T = I_{BAT} + \underset{\text{(PA Emitter)}}{I_{TRANS}} + I_{BEACON} + I_{MISC}$$

Using the sample data (current in mA.):

$$265 = 130 + 120 + 0 + I_{MISC}$$

$$\therefore I_{MISC} = 15 \text{ mA.}$$

This miscellaneous current is used to power the instrumentation switching regulator which provides regulated voltages to all of the sub-systems. The terms of this equation change continually throughout the orbit. As an example, when Oscar 6 is in eclipse the solar array current will be zero and all of the current must be supplied by the NiCd battery. Since the battery will be discharging during this period the I_{BAT} channel will be negative. The battery voltage from the sample data is 24.2 volts. Since there are 18 separate cells the voltage per cell is 1.32 volts. When fully charged the voltage of a NiCd cell is about 1.38 volts, giving a total battery voltage of about 25 volts. So for this example the battery is in a fully charged condition.

The battery voltage should not be allowed to go below 20.0 volts or about 1.1 volts per cell. The battery may also be checked by observing $V_{\frac{1}{2}BAT}$ or one-half of the battery voltage. From this measurement we can tell if each half of the battery is approximately at the same potential. In our example, it appears that two halves of the battery are balanced within 0.2v., which is about the resolution of the telemetry encoder. (Keep in mind that the encoder is digital in nature and the accuracy is ±1 count.)

Now that we are sure that the total array current is normal, each array should be checked separately for its output. It is noted that the +X, +Z and —Y faces all are reading a substantial current, indicating they are the panels being illuminated by the sun. The —X, +Y and —Z faces in our simulation are reading slight currents which would be due to the earth's albedo or reflected solar energy.

If we sum the current from each array we obtain: 32 mA. + 4 mA. + 164 mA. + 2 mA. + 70 mA. + 0 mA. = 272 mA., which is slightly higher than the measured value for I_T (Channel 1). Recall that the measurements for each panel were not made simultaneously but were sampled over a period of several seconds. The spacecraft has rotated during this time (a considerable amount just after launch) so that perhaps the current from the —Y panel has increased since the +X and +Z measurements were made. Only after several months in orbit when the spin rate is near zero should these two data compare closely.

This suggests, then, that the orientation of the spacecraft can be determined by knowing the current from the array. Actually this is quite easy to do because we are assisted by a simplifying characteristic of solar cells. The current available from a given panel is proportional to the cosine of the angle between the sun and the normal to the panel. This relationship holds for angles between 0 and 90°. Each panel has a maximum current which occurs at normal incident illumination (0° sun angle) at a given temperature. The

angle of each panel relative to the sun line is then simply:

$$\cos \theta_{X\ Y\ \text{OR}\ Z} = \frac{\text{I measured}}{\text{I max}_{X\ Y\ \text{OR}\ Z}}$$

To check the results of these calculations, we may use a characteristic identity of direction cosines:

$$\cos^2\theta_X + \cos^2\theta_Y + \cos^2\theta_Z = 1$$

This identity, of course, will not hold exactly until the satellite spin rate is very low for the reasons given above. Inaccuracies in these spacecraft attitude estimates will result from changes in the values of I max. The maximum array current changes as a function of temperature and time in space. It should be possible, however, to determine the spacecraft's exact orientation to ±5° during the first few months of the AO-C lifetime.

Observing the temperature within the spacecraft will give important information. As with Australis-Oscar 5, the +X, +Y and +Z face temperature will be several degrees warmer in the sun than when the panel is looking into space. A periodic temperature function will be noticed by plotting the +Y and +Z temperature data; since this is the spacecraft spin axis. In our simulation the +X face was warmer since it does not experience rotation in and out of the sun on a short term basis. The temperature difference from inside the satellite to its outer surface (the thermal gradient of the structure) is of importance to us. Using the baseplate temperature we can calculate the gradient along each axis.

$$\Delta T_X = T_{+X} - T_{BP} = +5.8°C$$
$$\Delta T_Y = T_{+Y} - T_{BP} = -1.5°C$$
$$\Delta T_Z = T_{+Z} - T_{BP} = -1.5°C$$

The temperature of the final transistor in the 2 metre/10 metre translator is of considerable importance. For good efficiency this temperature should be nearly equal to the base-plate temperature (about 1 or 2 degrees higher); in our example a difference of 7.6°C is indicated. If this were an actual measurement a problem would be suspected and the translator would probably be turned off by command.

In order of priorities the translator operation is second only to the power system performance parameters. If we check its performance in the simulation we note that the r.f. power output is 1.09 watts. The d.c. input to the final amplifier is calculated by multiplying the unregulated bus voltage (battery voltage) by the emitter current of the power amplifier transistor (Channel 18).

In the example given:

$$I_{PA} \times V_{BUS} = 2.90 \text{ Watts}$$

The translator's p.a. efficiency is then:

$$\text{Eff}_{PA} = \frac{P_{RF}\ (\text{out})}{P_{DC}\ (\text{in})}$$

$$= \frac{1.09}{2.90}$$

$$= 37.6\%$$

which is slightly higher than we are presently expecting and disagrees somewhat with what we would expect given the thermal problem mentioned earlier.

The a.g.c. loop voltage is quite high (2.62 volts out of a possible 3.00 volts) indicating the translator is heavily loaded. This can also be near the maximum value. From the beacon power output and the current balance equation it can be seen that the 435 MHz. beacon transmitter is off.

Channel 24 of the telemetry encoder is a calibration channel for the encoder itself. A voltage reference of 0.5 volt is measured on this channel and the encoder should respond with an output of 50 counts (±1 error count). This 0.5 volt reference is used for all of the thermistors as well and has been very carefully regulated. This channel will allow us to recalibrate the encoder in flight should this become necessary.

Chan. No.	Parameter	Unit	Parameter Range	Final Calibration Data/Comments*
1A	Total Array	I (mA.)	0 to 500 mA.	$I_T = 5.00$ N (mA.)
1B	+X Solar Panel	I (mA.)	0 to 100 mA.	$I_{+X} = 1.00$ N (mA.)
1C	—X Solar Panel	I (mA.)	0 to 100 mA.	$I_{-X} = 1.00$ N (mA.)
1D	+Y Solar Panel	I (mA.)	0 to 200 mA.	$I_{+Y} = 2.00$ N (mA.)
2A	—Y Solar Panel	I (mA.)	0 to 194 mA.	$I_{-X} = 1.94$ N (mA.)
2B	+Z Solar Panel	I (mA.)	0 to 370 mA.	$I_{+Z} = 3.72$ N (mA.)
2C	—Z Solar Panel	I (mA.)	0 to 370 mA.	$I_{-Z} = 3.68$ N (mA.)
2D	Bat. Charge or Discharge	I (mA.)	—500 to +500 mA.	$I_{BAT} = 10.00$ N —500 (mA.)
3A	Unregulat. Bus	V	12.4 to 30 V.	$V_{BUS} = 0.174$ N 12.4 (Volts)
3B	Half Battery	V	0 to 15 V.	$V_{\frac{1}{2}BAT} = 0.161$ N (Volts)
3C	Switching Reg.	V	0 to 15 V.	$V_{SR} = 0.147$ N (Volts)
3D	Battery Temp.	°C	—30 to +50°C	$T_{BAT} = -1.471$ N + 95.79 (°C)
4A	Base-plate Temp.	°C	—30 to +50°C	$T_{BP} = -1.471$ N + 95.79 (°C)
4B	Translator P.A. Temp.	°C	—30 to +50°C	$T_{PA} = -1.471$ N + 95.79 (°C)
4C	+X Panel Temp.	°C	—30 to +50°C	$T_{+X} = -1.471$ N + 95.79 (°C)
4D	+Y Panel Temp.	°C	—30 to +50°C	$T_{+Y} = -1.471$ N + 95.79 (°C)
5A	+Z Panel Temp.	°C	—30 to +50°C	$T_{+Z} = -1.471$ N + 95.79 (°C)
5B	Translator P.A. Emitter	I (mA.)	0 to 500 mA.	$I_{PA} = 5.00$ N (mA.)
5C	Transla. Sw. Reg.	V	0 to 30 V.	$V_{TSR} = 0.30$ N (Volts)
5D	Instr. Sw. Reg.	I (mA.)	3.8 to 63.8 mA.	$I_{ISR} = 0.601$ N + 3.80 (mA.)
6A	Translator R.F. Power	W	0 to 10 W.	$P_{OUT} = 0.001\ (N)^2$ (W.)
6B	435 MHz. Beacon R.F. Power	mW.	0 to 1 W.	$P_{OUT} = 0.10\ (N)^2$ (mW.)
6C	Translator A.G.C.	V	0 to 3 V.	$V_{AGC} = 0.03$ N (Volts)
6D	Mid-range Cal.	V	0 to 1 V.	N = 50 counts ±1

AO-C Data to be Telemetered by the Morse Code Telemetry System.

* N = Value Telemetered (omit first digit, which identifies the data line number)

PRE-LAUNCH ORBITAL DATA

ITOS-D orbital elements for middle of window (1731z), October 11, 1972, launch:

Epoch 18h36.92 m.
Semimajor axis 7839.845 km.
Eccentricity 0.000257.
Inclination 101.760°.
Mean anomaly 265.920°.
Argument of perigee 78.401°.
Motion of arg. of perigee —1.9168°/day.
Right asc. of ascending node 297.546°.
Motion of right ascension +0.9862°/day.
Anom. period 115.13799 min.
Height of perigee 1459.66 km.
Apogee 1463.70 km.
Velocity at perigee 25676.0 km./hr.
Velocity at apogee 25663.0 km./hr.
Geogr. lat. of perigee +73.539°W.
Local time of ascending node 2106.07.
Local time of descending node 0906.06.
Longitude increment 28.81°/orbit.

SATELLITE TRACK CALCULATOR

(continued from page 3)

cycle of orbits. Rotate the track so that the start of an orbit is at 173°W and assume the time is 1800 E.A.S.T.

Study the track and see that at 1 hr. 42 m. after the start it passes over ZL and to the east of VK to cross the equator at 201.8°W at 1955 hrs. Now rotate the perspex so that the start is now over 201.8°W to see the track for the next orbit. This will now be over VK and the times between a.o.s. and l.o.s. can be seen from where the track crosses the 0° elevation range ring, centred on your location, as well as the intermediate bearings and time.

Try the correct range ring for other locations to see the amount of overlap and whether the satellite will be in this overlap and at what time. Rotate the track around in 28.8° increments to see the other portion of the track that goes N-S. Continue to rotate the track around to find the next day's orbits. These will not be in the same place, but will appear to be further to the west and later by 55 minutes, but a pattern can be derived to make day to day predictions easier.

From Table 1 it will be seen that the tracks will be almost in the same position every second day and 5 minutes earlier. This may not be wholly true in practice as a variation of the nominal period of 0.1 minute will alter the time over two days by 2.5 minutes. The predictions can of course be updated by the time differences found in practice.

Orbit	Time	°W
100	1800	173
101	1955	201.8
113	1855	186.7
114	2050	215.5
125	1755	171.6
126	1950	200.4
139	2045	214.1
140	2245	242.9

Table 1.

USING THE PREDICTION INFORMATION

Generally following a satellite by beam swinging for maximum signal is unsatisfactory, especially for the lone operator who may be attempting to make a QSO at the same time. Due to the relative broadness of a 29 MHz. beam compared with the associated 144 MHz. beam, when using AO-C, a good signal could be received when the 144 MHz. beam is off the peak for transmission into the satellite.

To prepare for a particular pass, from the calculator find the bearing and times at a.o.s. and thence at two or three minute intervals up to l.o.s. Start with the aerial array at the first bearing and step it around at the correct times to the predicted bearings. Continue to do this even if the signals are weak or inaudible. The equipment set-up should ensure that the 29 MHz. output can be monitored while transmitting on 144 MHz. This enables you to listen for your return signal from the satellite and a check can be made of the correctness of the beam heading if desired. ●

ACKNOWLEDGMENTS

I wish to thank L. Dowl, VK7ZLD, for his work in drawing up the calculator and for the encouragement given to me by other local Amateurs when shown the calculator in the embryo state.

REFERENCES

1. "Satellites and Scientific Research," Desmond King-Hele.
2. "The Oscalator," "CQ" August 1965.
3. "Oscar Predictions," March 1965.

A SOLID STATE ELECTRONIC KEYER

I. E. HUSER, VK5QV*

● A not-too-difficult approach to the production of an all-electronic automatic key. Seven transistors and sundry other components, plus a few easily provided bits of hardware, result in a device which does all and more than the old electro-mechanical "bug" with no moving parts except the activating paddle.

With the acquisition of an FT200 transceiver, it was felt that a more suitable "shack" than the shed at the end of the garden should be sought. After a little "brainwashing," the XYL (with some reservation) allowed the rig to be installed in a corner of the bedroom—the loungeroom being definitely out of the question.

Headphones were installed so that the "banging, crashing, and good-day Jack I'm using, 'so and so' gear and the weather is lousy, etc." (the XYL's words) would not irritate anyone. So to achieve complete silence when working DX late at night, it was decided that a completely solid-state key should be obtained.

Having read an article about a simple electronic key using two relays and a handful of parts, a key was built and it worked just as the article said it would. However, it was decided that better results might be obtained if the relays were eliminated, and so the challenge presented itself.

By using basic logic circuits, and burning a little "midnight oil," a solid-state keyer capable of keying the FT200 directly without the use of a relay was built.

CIRCUIT OPERATION

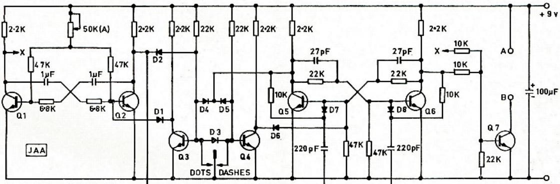
With reference to Figs. 1 and 2, it can be seen that the keyer circuit consists basically of two multivibrators, controlled by gates, and a keying transistor. The free-running multivibrator (Q1-Q2) produces a series of square pulses having a 1:1 mark-space ratio; the repetition rate, and hence the keying speed, being continuously variable between set limits by the 50K variable resistor in the multivibrator timing circuit. The output from this multivibrator is fed to the keying transistor (Q7) to produce a series of "dots," each having the correct length and the correct spacing between them.

The bistable multivibrator (Q4-Q5) is triggered by pulses derived from the free-running multivibrator, and produces a square-wave output with a 2:1 mark-space ratio which is also fed to the keying transistor. The outputs from both multivibrators are thus combined to produce dashes of correct length and correct spacing (see Fig. 3).

With the paddle in the neutral position, both multivibrators are held off by the gating transistors (Q3-Q4) and no output is obtained from the keyer. If the paddle is moved to the "dot" position, gating transistor Q3 ceases to conduct, the clamp is removed from the free-running multivibrator and a series of dots will be produced for as long as the paddle is held in this position. If the paddle is moved to the "dash" position, the clamps are removed from both multivibrators and their combined outputs produce the required dashes.

It should be noted that gating is so arranged that once a dot or dash has been initiated, it will be completed together with the following space irrespective of the position of the paddle.

* 5 Mugford Street, Mt. Gambier, S.A., 5290.



Q1-Q7 SILICON TRANSISTORS (SEE TEXT FOR TYPES.)
D1-D8 OA91 DIODES

FIG 1

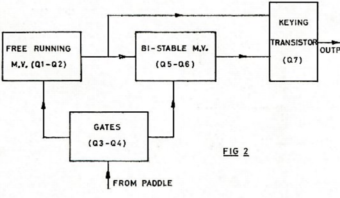


FIG 2

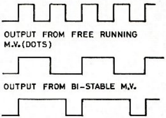


FIG 3

Hence it is a relatively simple matter to produce "copy book" Morse.

The output from the keyer (terminals A and B) could be used to operate a relay if so desided; however by suitably modifying the circuitry and choosing a suitable keying method, the device can be made to key directly a transmitter or tone oscillator.

CODE PRACTICE

It is desirable that a method of code practice be available to operators new to electronic keys before they go "on the air".

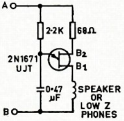


FIG 4a PRACTICE OSCILLATOR

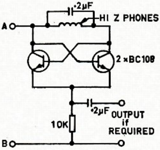


FIG 4b PRACTICE OSCILLATOR

Fig. 4 shows two circuits which can be connected between terminals A and B of the keyer for this purpose. Circuit values may have to be changed slightly to obtain a suitable tone consistent with the amount of inductance in circuit and the likes of the individual operator, etc. Either PNP or NPN transistors can be used in the circuit shown in Fig. 4b, bearing in mind that points A and B will have to be reversed when using PNP transistors to maintain correct polarity to the circuit.

TRANSMITTER KEYING

Fig. 5 shows how the keyer can be used in conjunction with an SCR to key the cathode of a low power stage of a transmitter. However, to ensure reliable turnoff, it is necessary that the cathode current of the tube be somewhat less than the holding current of the SCR used. Since the holding current for a low power 400 volt SCR is typically in the region of 10 mA., a stage having a low cathode current must be available.

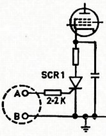


FIG 5 CATHODE KEYING of LOW POWER STAGE

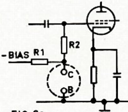


FIG 6a BLOCKED GRID KEYING

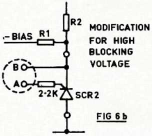


FIG 6b

In Fig. 6a, the keying transistor conducts under "key down" condition to remove blocking bias from the tube. Note that with this circuit the keying transistor must be able to withstand the "key up" voltage and it is suggested that a BC107 might be used for keying voltages up to say 40 volts. If PNP silicon transistors are used in the keyer, then a BC177 could be used as the keying transistor and point "C" would be more conveniently placed at ground potential. (N.B.—The diodes and rail polarities, etc., must be reversed when using PNP transistors.)

For blocking voltages greater than 40 voltages, the circuit in Fig. 6b could be tried if a suitable high voltage transistor is not available.

KEYING THE "FOX TANGO TWO HUNDRED"

When using the keyer in conjunction with an FT200 transceiver a high voltage transistor or the SCR circuit of Fig. 6b should be used since the "key up" voltage is in the region of 100 volts.

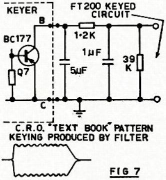


FIG 7

However, a small cheap low voltage transistor can be used if a 3.9K resistor is wired across the key socket. This has the effect of reducing the "key up"

(continued on page 16)

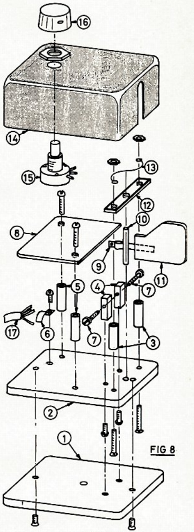


FIG 8

MATERIALS LIST

Part No.	Description and Material
1	Base plate—¼" thick mild steel or brass plate.
2	Sub-assembly plate—¼" thick bakelite or perspex.
3	Tubular spacers—brass tubing or bakelite.
4	Contact standoffs—brass (obtained from polarised relay).
5	P.C.B. standoff insulators—bakelite.
6	Cable clamp—brass, aluminium, etc.
7	Contact screws—obtained from polarised relay.
8	P.C.B.—P.C.B. or Veroboard.
9	Double-sided contact—obtained from polarised relay.
10	Paddle pivot—1/8" silver steel.
11	Paddle handle—3/16" bakelite or perspex.
12	Top bearing plate—3/16" bakelite or perspex.
13	Return spring—0.028" phosphor-bronze wire.
14	Cover—suitable plastic box.
15	Speed control—50KA potentiometer.
16	Control knob—any suitable knob.
17	Connecting cable—shielded multi-core cable.

AN INTEGRATED CIRCUIT I.F. STRIP

JOHN E. DUNKLEY, VK5JE (Ex VK5ZJD)*

● An outboard i.f./detector strip suitable for improving the selectivity of a receiver for r.t.t.y. reception.

Having recently become interested in the r.t.t.y. mode of communication, it did not take me long to realise that my communications receiver needed some additions and/or modifications or it "had to go". After extensive modifications to the power supply (adding VR tube), b.f.o. and taking care of some mechanical details, the drift problem was made bearable but the set itself lacked the ability to be selective enough for close channel reception of r.t.t.y. transmissions. In conditions of crowded Amateur bands, perfect copy of r.t.ty. transmissions was almost impossible.

The 120 pF. capacitors across the input and output coils of the mechanical filter should be 5% types or better and preferably high stability types, e.g. silver mica (SM). The IC is conventionally wired and do not forget the capacitor (0.1 μF.) from pin 2 to earth. An R.C.S. type 178 455 kHz. i.f. transformer was used to couple the output of the IC to the product detector. This unit was used because it was in the junk box but other types could be used without circuit modification. This particular type is one of the larger variety i.f. transformers as used in the miniature valve mantle sets, but if size is a problem a miniature "transistorised" version could be substituted.

The product detector is one which works very well with a minimum number of parts and provided the b.f.o.

to anything, however a 50K ohm potentiometer connected between pin 4 of the IC to earth provides a manual i.f. gain control (see Fig. 2). A 0.01 μF. capacitor connected from pin 4 to earth (provision for mounting this is provided on the p.c. card) takes care of any possible instability problems. This capacitor need not be used if the manual gain control is not incorporated.

A second independent amplifier providing some 30 dB. of gain is also available in this IC and although not used in this i.f. it is "earmarked" for use in the a.f.c. unit mentioned at the beginning of this article.

The leads to the a.m.-s.s.b. switch should be kept as short as possible, preferably shielded and the switch is normally open for s.s.b. and c.w., and normally closed for a.m.

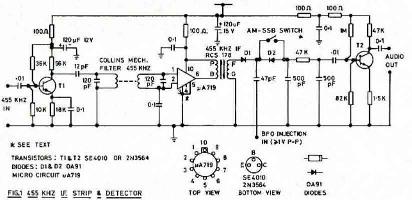


FIG.1 455 KHZ I.F. STRIP & DETECTOR

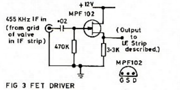


FIG 3 FET DRIVER

It was decided that an outboard i.f. strip and detector would be a good start to "updating" the receiver side of the shack equipment, and would also be a good interim start for an all transistorised a.f.c. controlled receiver for serious r.t.t.y., c.w., s.s.b. copy. Having decided that the i.f. strip would be a good place to start this project, things started to move.

The heart of the i.f. strip is a 455 kHz. mechanical filter having a pass band of 2.1 kHz. This is followed by a Fairchild IC type uA719.

Looking at the circuit (Fig. 1) we find that the first active device, T1, provides some amplification at 455 kHz. and also provides the correct matching for the mechanical filter. It should be pointed out that the coupling to the mechanical filter is done by a 12 pF. capacitor and this value is the **maximum** that can be used if the pass band characteristic of the filter is to remain unchanged.

*9 Elva Avenue, Pooraka, South Aust., 5095.

injection is greater than 1 volt p-p no problems should be encountered in this section.

Finally, some amplification at audio frequencies is provided by T2.

As can be seen from Fig. 1 the whole unit operates from a +12v. supply and the current requirement is only 20 mA. The three sections are each decoupled from the supply and no instability was encountered even during the initial breadboard stage.

The IC has an in-built facility for a.g.c., having a range greater than 30 dB., but if this is not required, pin 4 must be left open, i.e. **not** connected

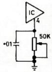


FIG 2 MANUAL GAIN CONTROL (IF REQUIRED)

The alignment procedure is about as simple as anyone could ask for. It involves providing a 455 kHz. modulated signal at the centre of the mechanical filter passband, selecting the a.m. switch position and monitoring the collector of T2 with a c.r.o. or a.c. voltmeter and adjusting the primary and secondary slugs in the i.f. coil for maximum reading. Measuring the d.c. current drawn (20 mA.) will give a good indication that all is well. The input signal to the i.f. for this alignment need only be in the region of 10 μV. When aligned, a 1 μV. 455 kHz. signal is detectable.

To connect the i.f. strip to a valve type receiver a FET driver can be added to the receiver. A suitable driver is shown in Fig. 3. Note: The driver unit should be mounted within the valve receiver. ●

A SOLID STATE ELECTRONIC KEYER

(continued from page 14)

voltage to approximately 30 volts without affecting the keying characteristics of the transmitter, thus allowing transistors such as the BC107 (NPN) and tthe BC177 (PNP) to be used.

The FT200 is renowned for keying transients and this, coupled with the inherent fast switching times of the keyer, caused some problems with "thumping".

Many ideas were tried, and eventually the "brute force" filter shown in Fig. 7 was adopted and wired **in place of** the original Yaesu filter. Values appear to be fairly critical, but a keying characteristic with a slight "thump" on the make and a clean break was obtained using the values shown.

CONSTRUCTION

The keyer can be built using the hand tools normally found in the experimenter's workshop. Fig. 8, together with the materials list, should give intending "smoke signallers" a good idea of construction, however a few points should be made:—

1. The size of the keyer is necessarily a function of the box available and since the original was built around a plastic box of dubious origin, measurements have purposely been omitted.
2. The fixed and moving contacts were obtained from an old P.M.G. polarised relay which had been lying in the junk box for many years. A few of these are still available through disposal houses at a reasonable price.
3. All the electronic components were mounted on "vero-board" which fitted neatly inside the keyer. A printed circuit board of course would make for a neater job.
4. If steel or brass is used for the base plate, a piece of 1/32" sheet rubber glued (with contact adhesive) to the underside will prevent any tendency to slip even on quite smooth surfaces.

FINAL COMMENT

The arrangement used at VK5QV is the tone oscillator shown in Fig. 4b (using AC128 transistors) and the PNP keyer. A switch is used to allow the practice and transmitter keying functions to be readily selected. Output from the tone oscillator is fed to a tape recorder so that any practice sessions can be recorded and evaluated.

The unit is powered from 9 volts obtained from a simple transistor series regulator.

Good luck and good DX! ●

AMATEUR FREQUENCIES:
USE THEM OR LOSE THEM!

NEWCOMER'S NOTEBOOK

With Rodney Champness,* VK3UG

The contribution this month is rather short as I am in the process of shifting my home due to the nature of my employment. My thanks to those who have taken the trouble to write to me, with ideas, circuits and requests for help. I may not be in the position to reply to all directly, but I do expect to help via "Newcomer's Notebook" wherever this is possible.

I have an offer from Miles Turner, 45 Kent Street, Kallagur, Brisbane, 4503, of information on the old A.W.A. 709C series of eight-valve seven-wave band receivers. These sets, although bulky and using octal-based valves, should prove to be well worth overhauling. They tune narrow bands, with continuous coverage, from 530 kHz. through to 23 MHz. They have an r.f. stage, and in general are built very solidly. The r.f. section is rather cluttered but with care and the use of a small soldering iron, routine maintenance and modification should not cause much trouble.

The addition of a small oscillator bandspreading capacitor, as mentioned in September "A.R.," and the fitting of a product detector, which will be part of a future issue, would make these rather oldish but well designed sets suitable for the commonly used h.f. transmission modes.

I suggest you write to Miles if you require data on these sets.

I have been asked by a reader if I could build a converter to go on the front of an old dual-wave receiver. It would certainly be possible, but there are two reasons why I cannot oblige: (1) that my time is restricted, and (2) that it is the aim of "Newcomer's Notebook" to help you to build or assemble for yourself some or all of your receiving or transmitting/receiving station. "One-offs" for projects some time in the future may be a possibility.

Some future articles will be on television interference as caused by 6 metre Amateurs, basic test equipment, and learning morse code. ●

* 44 Rathmullen Road, Boronia, Vic., 3155.

CORRECTIONS TO VK-ZL 1972 CONTEST RESULTS

Phone Section

	14 MHz.	Total
VK4DO	7000	7000
VK2ABC	5570	5570
VK2EB	3480	3480

AROUND THE TRADE

R. H. Cunningham Pty. Ltd. announce their appointment as exclusive distributors in Australia for the complete line of wiring components (pan-ty sta strap cable ties, harness accessories and allied items) manufactured by Panduit Corporation of the U.S.A. Both open and bond stocks are available.

Commercial Kinks

With Ron Fisher,* VK3OM

Since starting this column several months ago, the Trio 9R 59DE/s receiver has without doubt stirred up the most interest. My incoming mail seems to indicate that there is at least ten times the demand for information on this receiver than there is even for the FT200. Perhaps there is a moral in this, but I must leave our readers to work it out. Therefore this month I am going to publish a few extracts from letters I have received over the last few months. I hope this will enable Trio owners to compare their problems and experiences. However, before getting onto them I intend to continue with the Carphone conversions from Peter Campbell, VK2AXJ.

CONVERSION OF A.W.A. F.M. CARPHONES, Part 2

High-band Carphone to 146 MHz.—Transmitter: Add 6.8 pF. across each winding of TR8. Add 1.8 pF. across L9. Rewind L11 with 4 turns of 16 s.w.g. Remove C94, C115 and relay RL2. Receiver: Add 1.8 pF. to L4.

Low-band MR10B to 52 MHz.—Transmitter: Add 15 pF. across both windings of LT4. Rewind both LT5a and LT5b with 8 turns of 16 s.w.g. Rewind both LT6a and LT6b with 5 turns of 16 s.w.g. Receiver conversion: Rewind L1 with 18 turns of 24 B. & S. and tap at 3 turns from the cold end. Rewind T1 in the same way. Add capacity across T9 until it resonates at 40 MHz.

Low-band MR10C and MR20A to 52 MHz.—Transmitter conversion: Add 15 pF. across both windings of T11. Rewind L11 with 8 turns of 16 s.w.g. 5/16" diameter and ⅞" long. Rewind L12 in the same way. Rewind L13 with 6 turns of 16 s.w.g. 9/16" diameter and ⅞" long. Increase C125 to 100 pF. Receiver: Add 4.7 pF. to L1, 3.3 pF. to L2 and L3, and 10 pF. to L4 and L5.

Low-band MR20B to 52 MHz.—Transmitter conversion: Add 15 pF. to both L8 and L9. Rewind L11 with 6 turns, L12 with 18 turns and L15 with 10 turns. Receiver: Add 4.7 pF. to both L1 and L2. 3.3 pF. to L3, 10 pF. to L5 and L6. Increase C6 to 39 pF., but note that this value is critical and may vary on some units to achieve neutralisation.

In all the preceding modifications coils should be wound with the same diameter and spacing as the original unless otherwise specified.

If the narrow band filter, type 5Q57975, is removed and replaced with the wide band filter, type 3Q57975, the 2.2 pF. condenser across the input and output of the filter should be removed.

That completes the carphone data for the time being, but don't forget that circuits will continue to be available in the usual way.

THE TRIO 9R 59DE/DS

My thanks to all who have written to me with your ideas and comments about these receivers. Without exception, owners are generally happy with the performance of their sets. However, the Trio is very adaptable to small modifications similar to those covered in past issues of "Amateur Radio". One such change is a better tube in the r.f. stage in place of the 6BA6. There are several possibilities, the first being the 6BZ6. This would give a worthwhile lift in gain and only one small circuit change is necessary. Remove the earth connection to pin two of the r.f. tube V1. Now connect pin two to pin seven with a short piece of insulated wire. It is now possible to plug in either the original 6BA6 or the new 6BZ6.

A better choice, however, would be the EF183/6EH7. This tube has a transconductance of 12,500, nearly three times that of the 6BA6. To instal this tube in the Trio it is necessary to remove the existing 7-pin socket and replace it with a 9-pin socket. With such a hot tube some additional shielding is needed. Cut a piece of light gauge tin plate about 1" high and 1½" wide. Position this across the socket and solder it to pins 5, 6, the centre earth spigot and the nearby earth lug. The tube can now be wired up to the original circuit.

Chas Othen, VK5ON, reports some of his experiences. After making all the power supply improvements so far described, an extra electrolytic across the first section of C42 reduced the hum a further 50%. Chas used 16 μF., but I would think that 50 μF. would not be out of the way.

The b.f.o. developed trouble after about 12 months' use. It would either drift off frequency or drop out of oscillation altogether. After much searching, Chas traced the trouble to a 1,000 pF. 125v. condenser across the b.f.o. coil. This was replaced with a 1,000 pF. 600v. styroseal type.

He also reports improved reception with the help of a VK5AX preselector. This unit enjoyed great popularity during the middle 1950s, and was unique in that it tuned from 3 to 30 MHz. without the need for band switching. Apart from the extra gain, the front-end selectivity would be increased with a reduction in images on the higher bands.

An interesting modification comes from A. Graham, VK6ZCQ. He has transposed the b.f.o. and the i.f. input connections to the product detector V6 and says that this gives a more constant b.f.o. level. In a letter just received from Alex, he gives details of a cathode follower using the vacant half of the 6AQ8, and I will include circuit details in next month's issue. He reports an improvement in stability with this modification.

Neville Symons, L30448, also reported b.f.o. trouble. In the early 59DEs, the b.f.o. tuning condenser was apparently of poor design. After some use it developed wear and consequent frequency instability. Neville replaced this with the later type, which is the same as the one used for the antenna trimmer. Neville also improved warm-up drift by moving the OA2 regulator to the socket position intended for the calibrator tube. If you have already installed a calibrator, some form of heat shield might be worth a try.

I did intend to include some more FT200 modifications this month, but it looks as if I have run out of space again. Next month then, back to the FT200 and even more on the Trio 9R 59DE/DS. ●

* 3 Fairview Avenue, Glen Waverley, Vic., 3150.

☆

AFTER THOUGHTS

Some after thoughts on an F.M. Repeater by Ian Champion, VK5ZIP (see April and May 1972 "A.R.").

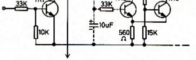
1. The power supply was labelled as 0.5 amp.—should be 5.0 amp.

2. Power supply. Pin 3 of the LM300 and the 1 μF. 35v. tantalum capacitor should be shown connected to the collector of 2N3442.

3. Ident control circuit. The collector/base feedback resistors of the bistable pair TR4/TR5 should be 47K ohms not 4K7 ohms. Likewise the tx control circuit.

4. The repeater now identifies as "VK5WI/R1"—25 w.p.m. m.c.w. from a new fully solid state IC keyer (installed January).

5. Sporadic interference from industrial r.f. generating equipment was causing idents ad nauseam. A modification was incorporated such that a minimum of three seconds of input signal was required before the ident. circuit recognised its presence.



MODIFICATION TO IDENTIFICATION CONTROL CIRCUIT

The value of the base resistor of TR2 (33K) is dependent on the β (beta) of TR2 (suggest >200) and the time delay required.

6. Now 100 Channel 4 operators in VK5 (and growing). ●

AWARDS COLUMN

With Geoff Wilson,* VK3AMK

W.I.A.—TASMANIAN DIVISION VK7 GOLDEN JUBILEE AWARD

(1) Radio Amateurs outside Australia and New Zealand to contact five (5) Tasmanian stations (VK7) during the period 1st January, 1973, to 31st December, 1973.

(2) Any recognised Amateur band may be used.

(3) Any Amateur mode of transmission may be used with cross mode being acceptable. Cross band working is not acceptable.

(4) A copy of the log showing date, time, band and other relevant details signed by the operator and two (2) other licensed Amateurs or by the operator and the Secretary of his Club to suffice for recognition of contacts. Isolated operators who are unable to comply with the above may request their logs be subject to check by the organisers.

(5) A suitable certificate inscribed with the number of Tasmanian stations worked will be issued to the operator as confirmation of the contacts.

(6) To ensure receipt of the certificate, IRCs will be sent with the log as follows: Sea Mail 3 IRCs, Air Mail 6 IRCs.

(7) Australian and New Zealand stations will be required to contact twenty (20) Tasmanian stations with the remainder of the Rules applying except that the QSL Bureaux be used for despatch of certificates unless the operator wanted service in (6) above, when 1 and 2 IRCs respectively will apply.

(8) Address for submission of logs:
VK7 Golden Jubilee Award,
Box 851J, G.P.O.,
Hobart, Tasmania, 7001.

HUNTER BRANCH AWARD

This certificate, awarded for outstanding performance in radio listening or two-way communications, is now available.

To qualify for the award, loggings must have been completed during any twelve-month period after 1st January, 1970. Certificates will be awarded in five classes.

(a) **For Overseas Stations.**—Must confirm that five different Hunter Valley Amateur stations have been contacted. No band limitation. Claims to be accompanied by a copy of the log and a declaration that QSL cards to confirm the contacts have been sent.

(b) **For Australian Stations.**—Must confirm that ten different Hunter Valley Amateur stations have been contacted. No band limitations. Does not apply to Amateurs resident in VK1 or VK2 call areas. Claims to be made as in class (a).

(c) **For N.S.W. and A.C.T. Stations.**—Must confirm that twenty different Hunter Valley Amateur stations have been contacted. No band limitations. Claims to be made as in class (a). Except that Hunter Valley stations must produce confirmation in the form of QSL cards.

(d) **For Hunter Valley Stations.**—Must confirm that one hundred different overseas countries have been contacted. No band limitation. Applies only to Hunter Valley stations and is an additional award to class (c). Claims must be accompanied by QSL cards.

(e) **For Hunter Valley Listening Stations.**—Must confirm that twenty-four different overseas countries have been logged while in contact with other Amateur stations. No band limitations. Loggings must include four stations each of the six continental areas as set out in the International Amateur Radio Union classification. Claims must be accompanied by QSL cards.

How to Claim the Hunter Branch Award.—The Hunter Branch Award may be claimed by submitting the necessary extract and QSL cards if required to:

Hunter Branch, W.I.A. Award Committee,
Box 134, P.O.,
Charlestown,
N.S.W., 2290, Australia.

Cost of the Hunter Branch Award Certificates to those applying for it will be $1.00 if posted airmail, 50 cents if surface mailed, 10 cents if it is collected at a Hunter Branch meeting.

Stations defined as being Hunter Valley stations must be established permanently as far as the definition accepted by the Radio Branch of the Postmaster-General's Department within the borders of the Hunter Valley as defined by the Hunter Valley Research Foundation.

The decision of the Hunter Branch W.I.A. Executive Committee will be final.

* 7 Norman Avenue, Frankston, Vic., 3199.

P.M.G. EXAMINATION PAPERS, AUGUST 1972

The following are the questions asked at the last examinations:—

SECTION K (REGULATIONS)

(Time allowed—30 minutes)

NOTE.—**Three questions only to be attempted.** Credit will not be given for more than three answers. **All questions carry equal marks.**

1. (a) State the regulatory requirements regarding the quality of transmissions from an amateur station.

   (b) Discuss the responsibilities of the licensee of an amateur station regarding the erection of an aerial mast.

2. (a) Give an example of a distress call sent by:
   (i) radiotelegraphy, and
   (ii) radiotelephony.

   (b) As an amateur station licensee what action would you take upon hearing a distress call?

3. What action should be taken by an amateur station licensee when informed that transmissions from his station are causing interference to the reception of television or broadcast programmes?

4. State the meaning of each of the following "Q" code signals:
   QRX QRT? QSY QRU QRH?

TELEGRAPHY

Section L (Receiving)

(Speed—10 words per minute)

Four months ago today Venus 8 departed this earth bound for

the searing planet The 472 degree Celsius heat prevents

soft landings by manned craft however a capsule dropped from

the spacecraft survived 50 minutes of this heat together

with the atmospheric pressure some 90 times greater than

Section L (Sending)

Time allowed—2½ minutes
(Speed—10 words per minute)

This was the second capsule to transmit from Venus The first

lasted 23 minutes and came from the spacecraft Venus 7 in

1970 No man made craft has

SECTION M (THEORY)

(Time allowed—2½ hours)

NOTE.—**Seven questions only to be attempted.** Credit will not be given for more than seven answers. **All questions carry equal marks.**

1. (a) Draw the circuit diagram of an amateur station transmitter suitable for operation in the 144-148 MHz. band. Explain briefly the theory of operation of each stage of the transmitter.

   (b) Describe how you would tune the transmitter described in (a).

2. Assisted by a circuit diagram, explain the operation of a cascode radio-frequency amplifier suitable for use in a v.h.f. receiver.

3. (a) Describe, with the aid of a sketch, the operation of a type of microphone suitable for use at an amateur station.

   (b) Draw a circuit diagram of a solid-state type pre-amplifier suitable for use with a high impedance type microphone.

4. Discuss the limitations of a heterodyne type frequency meter when used alone for measuring frequencies in amateur bands 144 MHz. and above. What additional apparatus would you use to ensure that the measured frequency does in fact lie in the desired band? Briefly discuss the theory of operation of this additional piece of apparatus.

5. (a) What is a parasitic oscillation and how is it produced?

   (b) Why are parasitics undesirable in a transmitter?

   (c) Explain the methods you would adopt to locate and suppress them.

6. (a) Explain the possible causes of interference to television receivers from amateur station transmitters.

   (b) Discuss the technical precautions you would adopt to avoid interference from a transmitter to television and broadcast receivers.

7. (a) Discuss the factors which affect the D.C. resistance of a conductor.

   (b) Explain why the radio-frequency resistance of a conductor may differ from its D.C. resistance.

   (c) Describe a method of winding which will minimise inductive effects in a wire wound resistor.

8. (a) Discuss the features you consider an antenna, operating in the 14 MHz. amateur band, should possess to enable it to communicate effectively over very long distances.

   (b) With the aid of a sketch describe briefly an antenna possessing the features you have outlined in (a).

9. (a) Find the total capacity when three capacitors of 2, 4 and 5 microfarads respectively are connected:
   (i) in parallel, and
   (ii) in series.

   (b) Calculate the capacitive reactance of the series combination in (a) when connected across a 50 Hertz supply.

CONTESTS

With Peter Brown,* VK4PJ

Congratulations to VK5 on a fine effort which brought a well deserved win. Until the last few days it seemed to be a "pushover" for VK4, but VK5 made a great final effort with some 40 logs to win well. I would suggest that it was a case of VK5 making up their mind to win and getting "stuck into the job."

Geoff VK5TY himself posted the final batch, Phil VK5NN wrote a band plan and look at the percentage of high scorers.

VK4 was not far behind but is possibly getting complacent?

VK7 made another fine effort and participationwise they are easy winners. Congratulations on improving on last year's high.

I am pleased with this year's contest because we are on the "up" again. Only a small improvement but nevertheless an improvement. Next year let us aim for 700 logs, not very difficult really. Just 50 from VK3, 40 from VK2, and doubtless the small States could easily knock up 50 between them—VK6 could do that on its own. Let us make the effort for 1973.

Judging by the comments I was not the only person pleased with the contest and I have yet to work out how to acknowledge each note.

Frank VK4II, with such a fine score, is an experienced ex-Canadian contest operator and indicated that this was the best of over 100 contests in which he has participated.

Get that key out for next year—quite a few operators mentioned that they could not get a c.w. contact after a phone contact.

Next month I will pass on some of the comments for you to think about.

* * *

Now to the Ross Hull. Are you ready to help make a success of the contest?

As a matter of interest, VK1ZAD scored over 1800 points last Ross Hull Contest, but unfortunately I did not receive his log, although a copy was forwarded subsequently. Let me know immediately if your log is missing from results.

* * *

Look for the John Moyle National Field Day Contest rules in next "Amateur Radio". I am looking forward to you helping me make this a great contest. Have you thought of taking the XYL out for this day? The ZLs do just that; make it a picnic day for those who are in just to make the contest a success.

Don't forget that the ZLs will be around and I have written overseas to U.S.A., U.K., Japan and Germany offering certificates to the two overseas operators who make the greatest number of contacts with VK mobile or portable stations.

I am trying to make it a busy week-end.

* * *

Let us look at those dates again.

Nov. 25-26—CW "CQ" WW DX Contest.

Dec. 9-Jan. 21, 1973—Ross Hull Memorial VHF Contest.

Feb. 10-11, 1973—John Moyle Memorial National Field Day, Phone/CW, Portable/Mobile or VHF/HF.

* * *

Last thoughts. Have you thought of an R.D. Contest with one point per contact corrected for participation rate?? as an experiment??—VK4PJ.

R.D. CONTEST TO VK5

DETAILS OF DIVISIONAL SCORES

Div. ision	Logs	Licen-sees	% Partici-pation	Aver. Top Logs	State Pts.	State Score
VK5-8	125	779	16.1	1343	43177	8255
VK4-9	134	823	16.4	1196	36060	7043
VK7-0	66	227	29	855	13656	4827
VK2-1	121	2038	6	1309	40576	3718
VK3	89	1995	4.6	930	32349	2373
VK6	33	508	6.5	938	10411	1611

In the detailed Divisional results the first set of figures is for contacts made and the second set points scored. An asterisk indicates check log.

* Federal Contest Manager, Box 638, G.P.O., Brisbane, Qld., 4001.

AUSTRALIAN CAPITAL TERRITORY

VK1—Phone

GB	347	776	AN	164	355	MF	64	134
MP	305	642	GT	130	338	RH	43	62
GM	239	591	AOP	120	257	LN	5	11
BC	153	359	DI	82	201	ML	5	5
			ZT	83	161			

VK1—CW

VP	66	360
AG	16	58

VK1—Open

DA	302	875
EP	200	394
YR	159	311

NEW SOUTH WALES

VK2—Phone

XT	519	1389	RJ	148	324	ZZX	68	68
BNS	475	1349	CI	110	319	CF	22	67
BEC	517	1258	AIM	116	316	AFA	17	61
ASD	471	1057	AVJ	114	313	KQ	24	61
DM	382	1030	BDT	125	313	CU	17	52
RX	310	885	BKG	100	297	PZ	24	50
ATR	323	801	ADA	119	265	BLD	22	47
OH	237	632	HQ	100	256	YG	10	36
TS	208	581	NF	85	241	AWX	10	36
AGF	200	569	UJ	76	220	SW	28	30
QC	225	568	ACK	65	172	CS	16	29
APQ	197	559	BMX	56	166	AEC	9	23
VG	157	490	BYY	71	129	AAH	6	19
AWN	160	407	ATZ	59	135	ASJ	7	19
BDB	150	388	RU	31	124	ZMP	19	19
ZA	119	362	OS	41	114	ZVH	17	17
CO	141	361	AJL	31	106	LE	6	16
BDN	136	358	BMD	28	99	AKX	6	16
AXL	106	354	AGS	34	96	ZSG	16	16
AXJ	149	343	AYL	32	95	ZUT	13	13
ABC	103	326	APH	29	91	ZTP	11	11
			BJK	26	70			

VK2—CW

AGI	180	938	CX	149	390	AMB	61	178
BRA	168	916	BHO	163	302	IV	27	156
QL	126	768	WN	42	260	MT	41	108
VN	127	708	ZC	50	246	RY	20	106
GR	120	622	EO	48	244	BQQ	40	105
GT	111	602	ZO	33	188	BGG	15	70
HW	109	572	JY	41	184	XQ	17	33
YB	80	418				GS	8	30

VK2—Open

AHM	531	1352	BKH	118	398	AAC	31	149
BO	420	1280	PU	81	320	AQ	38	89
DO	470	1229	BRK	91	320	HZ	14	77
BNW	350	859	AJQ	85	310	BHD	20	71
ATT	218	556	BAZ	90	255	AGZ	13	35
			JM	71	209			

VK2—Receiving

C. Ferguson, L2046	957
J. Hilliard L2074	720
Birrong D.I.R.C.	650
S. Dwight	618
W. Newport	398

VICTORIA

VK3—Phone

AQO	532	1150	AYF	100	252	ZYP	84	84
BCF	525	1098	FE	100	241	OL	33	82
WW	413	885	ZD	131	240	JK	40	64
ADW	340	769	KK	100	236	ZU	37	59
AVP	341	757	AIS	106	204	DY	27	56
AXV	340	677	BFN	100	201	AER	26	54
ZY	314	635	AVJ	101	190	YGQ	51	51
BJB	279	627	LP	58	181	TG	19	50
BDL	341	608	ASI	105	177	CIF	15	46
CCR	275	604	EG	60	157	BCZ	25	43
ASV	241	550	LV	50	151	ARO	12	40
AJX	253	519	BCT	60	134	ZYO	35	35
EF	201	416	QZ	57	129	AHG	30	32
BBV	205	378	YAP	124	124	GS	10	28
ARY	178	358	WY	51	117	ALD	7	17
AZQ	149	341	PY	58	117	TZ	11	11
ANP	140	278	HE	60	109	ARA	5	8
ZJ	100	277	AJP	57	108	YFL	6	6
SM	109	275	RN	31	88	RA	5	5
			WM	29	86			

VK3—CW

XB	224	837	AMA	82	276	ABR	35	112
OP	214	820	YF	156	265	RJ	55	107
APN	205	792	ARK	57	238	KX	34	70
MR	178	597	BGF	51	202	AMD	18	64
FC	152	570	AXK	23	166	ZM	10	56
ZT	114	428	ZO	75	159	CM	7	22
			ABS	30	130			

VK3—Open

AVP	341	757	AYL	224	448	EZ	91	173
JI	252	717	YQ	153	373	ADP	39	72
QP	237	566	KF	100	302	KS	24	55
BDE	238	463	ASE	103	192	ZBB	46	46
			BGR	102	184			

VK3—Receiving

A. Groen, J. Grech, and T. Jones	1035
E. Trebilcock (all c.w.)	636
St. John's Col.	573
A. Cash	80

QUEENSLAND

VK4—Phone

QD	528	1226	RO/6	58	159	HW	26	57
EQ	461	1103	ZBV	156	155	FP	19	55
DJ	368	1014	LR	54	150	VW	85	55
ZQ	455	927	XZ	93	142	GM	30	53
DZ	349	926	PX	49	135	LO	20	52
FD	335	911	OF	51	131	XN	12	51
LZ	336	854	SR	95	126	CR	52	51
OW	312	668	RL	50	124	BG	17	48
VU	300	633	PJ	35	115	GT	27	44
AK	201	632	QF	49	115	ZHS	44	44
IC	280	628	UM	74	114	IQ	42	42
IN	243	614	FN	46	112	ZRC	42	42
LE	228	573	PV/P	41	106	ZJE	42	41
PS	223	562	QW	36	103	ZTK	34	34
DO	200	517	IO	73	100	QJ	15	33
MW	171	490	KH	31	99	VS	12	31
ZJ	186	432	CY	33	97	ZDC	30	30
RT	186	396	SD	27	95	OR	10	28
FA	169	384	XO	39	86	YG	10	27
HB	130	357	UG	50	85	QT	25	25
RP	114	332	RJ	38	84	ZZ	8	23
ZB	100	320	ZLC	84	84	AV	11	23
NQ	105	297	IA	80	82	ZTL	23	23
LN	109	291	PU	24	79	UC	11	22
HJ	103	287	ZMV	82	77	GP	15	21
FE	111	272	YT	31	66	SF	10	18
EB	94	264	ZRG	60	66	BQ	7	15
QA	87	249	ZBH	64	66	DV/M	15	15
ES	66	236	FU	25	65	EO	15	15
CZ	58	173	ZJO	66	65	KS	6	13
ZP	75	168	ZAF	63	63	ZRI	10	10
NO	72	165	NP	20	61	RG	6	9
EH	75	164	GS	21	61	ZAP	8	8
LA	60	163	ZML	61	61	ZMI	7	7
			IE	32	58			

VK4—CW

KX	126	644	XJ	28	176	VO	8	34
XW	153	413	GH	34	116	CN	8	20
OD	44	202	FJ	15	61	NJ	7	20
HH	40	178				KK	7	19

VK4—Open

II	515	1745	UX	347	963	RF	100	370
XY	281	1046	LT	261	892	LC	21	133
VX	358	1034	NB	208	598	RE	18	33
FH	373	1020	UA	176	487	HZ	13	30
			MY	100	430			

VK4—Receiving

B. Lenehan, L4182	423
L. R. W. Ernst	340
Chas Thorpe	240

SOUTH AUSTRALIA

VK5—Phone

BW	576	1404	FD	120	319	ZKT	102	102
NB	602	1273	ZQ	130	312	LQ	31	101
QX	494	1246	WI*	200	310	ZDX	101	101
BI	449	1198	EK	128	288	ZOF	101	101
JR	422	1068	ZU	90	281	ZIP	100	100
FT	399	1005	GZ	132	274	GU	45	99
NN	360	894	VI	120	273	DJ	60	98
SU	337	855	XV	100	250	ZFJ	92	92
ZZ	300	841	GX	86	227	ZJV	92	92
GM	332	833	PX	105	209	ZOS	91	91
LP	345	833	ZS	100	208	SS	64	80
WV	360	815	WO	70	203	LC	30	75
TY	333	809	ZDY	201	201	MS	30	62
TH	344	791	ID	70	194	ZHJ	55	55
UC	301	761	RR	80	179	ZK	41	53
PH	290	727	TW	112	176	ZNJ	52	52
VT	348	727	CY	68	174	ZBC	45	45
QV	287	685	ZKK	172	172	KS	19	42
ST	259	659	DK	76	165	AC	20	32
EF	227	610	OY	89	163	ZRH	28	28
UV	203	553	ZBB	154	154	QH	26	26
MC	214	543	RI	60	144	LL	15	25
ZB	206	519	HA	43	133	DF	12	23
ZT	277	481	WN	50	131	BF	7	21
LN	148	435	HN	110	126	KH	12	20
AX	157	430	QO	46	119	OT	11	18
VB	168	424	BQ	49	119	ZMO	18	18
NJ	125	343	ZN	118	118	DO	10	13
FL	112	319	TU	54	114	ZL	12	12
			AW	111	111			

VK5—CW

MY	150	674	LD	68	312	RK	24	134
FM	105	466	HR	50	234	TL	34	90
FY	100	440	KU	54	218	LG	20	68
OR	88	426	MZ	41	194	KY	9	54
AU	85	396	RX	27	142	GF	10	54
FH	68	326	HO	39	140	QR	11	30

VK5—Open

NO	513	1649	WR	200	540	HM	102	212
RG	435	1289	DX	226	495	MA	59	151
EN	337	883	CL	169	309	JC	82	82
QI	194	644	LM	134	299			

VK5—Receiving

I. Kirk, L50145	852
R. Whitford	836
J. Rodgers	585
R. Edmeades, L50122	183

(continued on page 20)

R.D. CONTEST RESULTS

(continued from page 19)

WESTERN AUSTRALIA

VK6—Phone

ID	556	1290	AWI*	120	288	DZ	35	81
KW	497	1148	TU	88	207	XY	37	75
DA	388	868	WI/P*	75	169	SM	21	67
NE	286	674	MB	63	133	SR	26	57
RS	124	508	KJ	52	118	HT	17	43
FI	202	487	VK	40	96	XO	17	30
MF	175	397	EG	37	87	LF	9	9
			AN	46	87			

VK6—CW			VK6—Open		
BQ	162	756	CT	292	891
WT	142	648	LG	181	403
RL	43	202	CR	17	62
GA	30	142	HU	10	28
HD	23	92	SH/P	10	24

VK6—Receiving

B. Dolphin 1572 — T. McGrath, L60121 307

TASMANIA

VK7—Phone

JV	566	1287	ZGJ	119	119	RX	10	41
UX/P	255	491	ZIE	113	113	LD	37	37
MS	215	451	ZRF	98	98	NZ	33	35
MZ	135	417	CL	34	94	ZLH	35	35
MX	160	347	AB	30	80	ZGT	33	33
KH/P	137	312	ZLD	79	79	ZRJ	31	31
AK	117	311	ZWX	79	79	HW	21	29
KK	153	284	CK	21	66	ZSF	27	27
BM/P	131	266	PS	64	64	PD	25	25
GW	115	200	SF	22	53	ZX	24	24
LS	82	145	GB	36	50	ZMF	15	15
PF	102	144	ZJG	51	50	AX	12	12
ZIF	143	143	ZFR	44	44	RO	11	11
ZNR	143	143	MK	44	44	ZBE	10	10
VK	62	139	ZEC	42	42	BB	8	8

VK7—CW

CH	163	676	RY	128	408	BJ	31	112
LJ	137	528	CIC	78	296	RD	40	112
GV	133	502	OM	71	236	JB	30	80
MZ	135	417				YL	10	32

VK7—Open

KJ	614	1361	AL	93	240	LZ	32	89
FB	323	683	EJ	106	174	GB	36	50
RH	230	468	JA	42	120	ZBY	46	46
BC	91	323				CF	30	45

VK7—Receiving

R. J. Severett 799

NORTHERN TERRITORY

VK8—Phone			VK8—CW		
CM	336	773	HA	121	474
CW	206	390	ZZ	106	424
DI	132	277			
AZ	44	122			
JS	74	112			
KP	18	47			

PAPUA-NEW GUINEA

VK9—Phone			VK9—CW		
BK	367	860	VO	22	116
GA	265	605			
KA	232	569			
DM	243	520	**VK9—Open**		
RY	174	490	DH	203	551

CHRISTMAS ISLAND

XX 100 244

ANTARCTICA

VK0

JV 97-597

NEW ZEALAND

Phone			CW		
ZM1AMN	470	1064	ZL1DV	58	254
ZL1ARO	181	379	ZL2IQ	94	340
ZL1AGO	82	169			
ZM2ACP	181	651			
ZM2GJ	250	498	**Open**		
ZM2IK*	27		ZL1AXB	341	872
ZM3ABC	265	537	ZM1ACL	309	741
ZL3FM	217	447	ZL4CA	96	241

☆

You and DX

We regret the non-appearance of the notes this month caused by the Contributing Editor's change in QTH. Meanwhile a note from KH6BZF about the Kure and Midway Islands DX-pedition indicates that W7WOX (KH6HGP) and the group will head out of Honolulu about 22nd October so as to operate a few days before, during and after the "CQ" W.W. DX Test (s.s.b.) on 28th-29th Oct. from Midway. Frequencies given include 14205/14280 kHz., 21260/21300 kHz. and 7205/7290 kHz. QSL to KH6BZF with three IRCs plus SAE.

Congratulations to David Rankin, VK3QV, upon acquiring the call 9V1RH.

VHF UHF
an expanding world

With Eric Jamieson,* VK5LP

Closing date for copy: 30th of month.
Times: E.A.S.T.

AMATEUR BAND BEACONS

VK0	52.100	VK0ZVS, Macquarie Island.†
	53.100	VK0MA, Mawson.
	53.200	VK0GR, Casey.
VK2	52.450	VK2WI, Dural.
VK3	144.700	VK3WI/R6, Vermont.
	144.925	VK3QZ, Traralgon.
VK4	52.400	VK4WI/2, Townsville.
	144.390	VK4WI/R1, Toowoomba.
VK5	53.000	VK5VF, Mt. Lofty.
	144.800	VK5VF, Mt. Lofty.
VK6	52.006	VK6VF, Bickley.
	52.900	VK6TS, Carnarvon.
	52.950	VK6VE, Mt. Barker.
	144.500	VK6VE, Albany.
	145.000	VK6VF, Bickley.
VK7	144.900	VK7VF, Devonport.
VK8	52.200	VK8VF, Darwin.
ZL1	145.100	ZL1VHF, Auckland.
ZL2	145.200	ZL2VHF, Wellington.
	145.250	ZL2VHP, Palmerston North.
	431.850	ZL2VHP, Palmerston North.
ZL3	145.300	ZL3VHF, Christchurch.
ZL4	145.400	ZL4VHF, Dunedin.
JA	52.500	JA1IGY, Japan.
HL	50.100	HL9WI, South Korea.

† VK0ZVS is again operating from Macquarie Island running 30 watts c.w. to a 3 el. beam on Australia. The keying cycle includes a pause during which stations may call in.

The listing of VK1VF in Canberra has been removed for the time being. Apparently I was misinformed that it was likely to be operational by September and the subsequent listing has caused some problems between the Canberra Radio Society and the P.M.G. Dept. I regret any inconvenience such listing may have caused. In future, I shall certainly be requiring definite evidence of the proper operation of any new beacons which may appear before adding to list, that's for sure!

2300 MHz. CONTACT—RECORD CLAIMED

Following an 18-month programme of building, testing and modification, a two-way contact was made on Sunday, 3rd Sept., 1972, using 2304 MHz. between Dick VK2BDN, operating portable at Glenbrook in the Lower Blue Mountains, and Bill VK2ZAC at his home QTH at Narwee, a distance of 28.5 statute miles. The contact commenced at 12.15 p.m. after a brief contact on 144 MHz. to finalise set-up details, and was maintained for 45 minutes, being limited by Dick's available battery power. Weather conditions were warm and calm, 20 degrees C. with some haze and the optical path exhibited some fading. Signal reports were VK2BDN reported 5 x 7 and VK2ZAC reporting 5 x 4. It is understood the previous best Australian Amateur contact on this frequency was 9 miles.

Equipment.—VK2BDN: transmitter, 144 MHz. exciter plus a series of varactor doublers to 2304 MHz., estimated power output 0.75 watt; modulation f.m., feed-line 7 feet of 50 ohm co-ax. to a 4-ft. dish with dipole feed, crystal controlled converter with 1N21D mixer, 144 MHz. first i.f. to a mobile communications receiver.

At VK2ZAC: Transmitter, 144 MHz. exciter, 3CX100A5 doublers to 576 MHz., 3CX100A5 quadrupler to 2304 MHz., estimated power output 1.5 watts. Modulation a.m. Feed-line—due to the need for home station operation at VK2ZAC—the antenna is supported on a lattice tower by means of an elevating truck which may be winched up and down for adjustment. To reduce feed-line losses a 15-ft. waveguide section plus co-axial transitions was built using 4 x 2 inch galvanised downpipe. Antenna 4-ft. dish with dipole feed. Receiver, crystal controlled converter, 1N21D mixer, 50 MHz. first i.f., transistor pre-amp. to a 6 metre converter and BC342 h.f. receiver fitted with a gated beam f.m. discriminator.

Congratulations to Dick and Bill for their efforts, and we hope to hear more from them as the operating distances are increased, and thanks to Bill for sending me the information.

* Forreston, S.A., 5233.

BLURB

I'm not trying to be rude! That's the title of the latest news bulletin to reach my office desk, this time from the "South East Radio Group" in Mt. Gambier, S.A., under the editorship of Dale VK5DA. Running to 10 pages, it has lots of information, even to including a recipe for a chocolate cake! I hope I may be able to select suitable paragraphs from its pages from time to time which will be of general interest. Good luck S.E.R.G. with the project.

QRM

This is another bulletin, and published by the Northern Zones of W.I.A. in Launceston, Tas., which I am grateful to receive. I note an interesting comment in the last issue regarding the Remembrance Day Contest, and I quote: "If Northern VK7 is any guide, adding the two hourly limit for reworking a v.h.f. station in the R.D. Contest must be the brain wave of the century. The enthusiasm of Z calls had to be heard to be believed—many of them made up to 150 contacts! Apparently 26 different call signs were heard through the Mt. Barrow repeater. Quite a few crystals around for a 'temporary' frequency!" Yes, I do believe the Federal Contest Committee has taken a step in the right direction and given v.h.f. operators extra incentive to join in our national contest, and hope they will support the idea.

50 MHz. MOONBOUNCE?

A letter has arrived at my desk in a very round-about way (through ZL3NB and VK3AKN) asking if I am interested in moonbounce operation on 50 MHz., with Joe Muscanere, WA5HNK, 6914 South Park Street, Houston, Texas. Actually, while the thought does interest me to a point, I do not have the kind of time required for such a venture, and my prevailing noise level is so high as to make very low level signals impossible to read. If there are any others who would like to try with Joe, I suggest you contact him personally by letter. He runs 650 watts output, and has received his own signals back from the moon.

PORTABLE OPERATIONS

This is the time of the year when operators begin to think about selecting sites for portable operation mostly during the Christmas and New Year break. If anyone has definite details of such operation available by 30th October perhaps you might send the details to me for inclusion in these notes for December. I see from the pages of the Geelong Amateur Radio-Television Club bulletin that Mike VK3ASQ is a likely starter around the New Year period. Are there any others?

VK3 ANTENNA DAY MEASUREMENTS

The Victorian "VHF-er" for Sept. contains details of 52, 144 and 432 MHz. antenna measurements, and serves to indicate the wide range of results which can be obtained by different constructors. Looking over the results the 11 element yagi on an 18-ft. boom seems to have performed fairly closely to accepted figures; this was submitted by VK3AUU. A comment at the end of the results indicated some multi-path problems existed with the tests and caution should be exercised in examining the results. However, readers of this page would find a look at the tabulated results quite worth while, if only further to add to your confusion.

Because you build an Orr and Johnson 10 element for 144 MHz. you might be lucky to get 12 or 13 dB. of gain, or it might be 5 dB. as these results have shown. The golden rule seems that "follow the specifications rigidly, vary them at your peril if you are not familiar with antenna behaviour".

TWO METRE SSB CALLING FREQUENCY

Also from the "VHF-er" is noted a motion passed at the August meeting of the VK3 V.h.f. Group that a frequency of 144.150 MHz. be used as a s.s.b. calling frequency. The idea of a calling frequency is good, but perhaps a final suitable frequency for all Australia might be considered by the present Band Planning Committee.

VHF FIELD DAYS

VK3 will be holding a special Field Day on 5th November using a miles per watt multiplier. On 3rd December there will be Field Days in VK3, VK5 and ZL, so perhaps it will be a Field Day for some. The National Field Day is scheduled for 10th and 11th February, 1973. It is time now to start planning for the National Field Day if you are likely to make a big effort and cover all bands.

MOBILE OPERATION

With the holiday season not so far away, many will be giving thought to interstate mobile operation. Bear in mind that for many years no special permission was needed, but now v.h.f. operators (as well as h.f.) require to notify the P.M.G. Dept. of the proposed dates of operation, and other relevant details as required by the Regulations as printed in the Handbook. Play safe, write early. [See page 2 of this issue.—Ed.]

That seems to be all the news for this month, and as space in these columns is still subject to pressure from the Editor of "A.R." no padding is used just to fill space. I close with the thought for the month: "The toughest part of politics is to satisfy the voter without giving him what he wants."—The Voice in the Hills.

NEW CALL SIGNS
JUNE-JULY 1972

VK1JD—J. Dalwood, Lawley House, Brisbane Ave., Barton, 2600.
VK1ZAZ—J. W. Carr, 34 Abernethy St., Weetangera, 2614.

VK2LL—C. L. Scully, 16/818 Victoria Rd., Ryde, 2112.
VK2ZS—W. J. Smith, 18 Prince St., Glenbrook, 2773.
VK2ZV—K. W. Gooley, Waldorf Private Hotel, 3 Milson Rd., Cremorne Point, 2090.
VK2AXG—J. H. Gingsberg, 1/282 Belmore Rd., Riverwood, 2210.
VK2BDI—R. Kilworth, 11/85 West Esplanade, Manly, 2095.
VK2BRF—R. G. Gill, 28 Lower Mount St., Wentworthville, 2145.
VK2BSX—W. F. Shepherd, 56 Wyong Rd., Mosman, 2088.
VK2BZX—P. J. Vernon, 12 Russell Ave., Lindfield, 2070.
VK2RAG—Central Coast Amateur Radio Club, Dandaloo St., Kariong, 2251.
VK2RAN/R2—Wireless Institute of Australia, Hunter Branch, 49 Valaud Cres., Highfields, 2289.
VK2RAO—Orange and District Radio Society, 255 Piesley St., Orange, 2800.
VK2RAS/R1—Wireless Institute of Australia, Station Dural; Postal: 14 Atcheson St., St. Leonards, 2065.
VK2ZNU—R. Ryback, 87 Evan St., Penrith, 2750.
VK2ZNX—P. Whaite, 5/51A Forsyth St., Kingford, 2032.
VK2ZQX—R. J. Martindale, 83 Windsor Rd., Dulwich Hill, 2203.
VK2ZXU—J. E. Anderson (Prof.), 75 Jabez St., Broken Hill, 2880.
VK2ZYQ—H. J. Smit, 9 Moore Cres., Faulconbridge, 2776.
VK2ZZP—G. S. Scott, 21 York St., Epping, 2121.
VK2ZZS—A. M. Adams, 3 Fernleigh Gardens, Rose Bay, 2029.
VK2ZZU—C. T. Coles, 111 Archer St., Chatswood, 2067.
VK2ZZY—P. L. Greaves, 80 Duffy Ave., Thornleigh, 2120.

VK3SA—J. Boer, 10/135 Mooltan St., Ascot Vale, 3032.
VK3AMG—J. Mellor, Station: Princes Highway, Alberton, 3970; Postal: P.O. Box 69, Yarram, 3971.
VK3BDS/T—E. H. Schoell, Lot 79, Anderson St., Boronia, 3155.
VK3BGI—O. H. R. Hobuss, 15 Bentwood Cres., Frankston, 3199.
VK3BGK—S. L. Spayde, 2 Kurrajona Ave., Glen Waverley, 3150.
VK3BGM—L. Sambell, 4792 Carson Pl., Burnary Cl., Canada.
VK3YGK—I. J. Dalwood, 7/8 Middle Rd., Maribyrnong, 3032.
VK3YHB—E. L. Bennett, 2 Melva St., East Bentleigh, 3165.
VK3ZLC—W. R. Knight, 17 Lucas St., Newcombe, 3219.
VK3ZQZ—D. Zovi, 28 Arnold St., Princes Hill, 3054.
VK3ZTN—N. J. Melford, Old Coonara Rd., Olinda, 3780.
VK3ZWA—W. R. Deitch, 26 Cantala Dr., Doncaster, 3108.

VK6CU—C. T. Younger, Station: U.S. Navcom Stn., Exmouth, 6707; Postal: P.O. Box 2, Exmouth, 6707.

VK9BD—R. Whitney, Station: Drill Barge, "J. C. Marthens"; Postal: C/o. Mr. Middlebrook, Papua Agencies Pty. Ltd., P.O. Box 120, Port Moresby.
VK9BO—N. R. Gustafsson, Station: Sect. 41, Lot 32, Boroko; Postal: P.O. Box 1864, Boroko.
VK9EJ—K. V. Ford, Station: Quail St., Lae; Postal: P.O. Box 1486, Lae.
VK9ZIF—I. Fletcher, C/o. Manus High School, Lorongau.

NEW PRODUCT—50 MHz. COUNTER KIT

Decade Counting Module for Frequency Counting, Time Measurement, Event Counting, etc.

1. 50 MHz. or 20 MHz. counting capability.
2. Module kit consists of 8290 or 7490, 7475, 7447 and Minitron 3015F.
3. Single plane 7 seg. readout.
4. Lamp test, selectable ripple blanking.
5. Decimal point.
6. PC, glass epoxy plug-in board.
7. Well documented application note with step-by-step assembly and hook-up instruction.

Gate Module F

1. Module consists of 7440, 7400, 7476 and 74500.
2. Adjustable reset generator.
3. Reset and strobe outputs.
4. Gate uses Schottky TTL.
5. PC, glass epoxy board.
6. Application note and assembly instruction.

Input Amp. and Pulse Shaper Module

1. 1 meg. ohm input impedance.
2. 20 mV. sensitivity at 50 MHz.
3. Diode protected FET input.
4. Frequency response 10 Hz. to 70 MHz. plus or minus 2 dB.
5. Glass epoxy PC board.
6. Application note and assembly instruction.

ALL Modules operate off plus 5 volts rail.

50 MHz. COUNTER KIT PRICE LIST

50 MHz. Decade Module	$22.50 ea.
20 MHz. Decade Module	$19.50 ea.
Gate Module F	$15.75 ea.
Input Amp. Module	$16.20 ea.

Packing and Post 25c.

Frequency Standard and Clock Divider to be announced.

INTEGRATED CIRCUITS

5N7490N	$2.20 ea.
SN7441AN	$2.75 ea.
SN7475N	$2.20 ea.
SN7400N	$1.00 ea.
SN7410N	$1.00 ea.
SN7430N	$1.00 ea.
SN7440N	$1.00 ea.
SN7472N	$1.85 ea.
SN7473N	$2.00 ea.
SN7447N	$3.20 ea.
LM709 Op.-Amp.	$1.50 ea.
LM305 Pos. Reg.	$3.80 ea.
LM304 Neg. Reg.	$4.90 ea.
TIL209 LED	$1.50 ea.

LM380 2 watt Audio IC, 12-18v. rail, 50K ohm input imp., voltage gain of 50, short circuit and overload protection. Price **$2.85 each**

Postage on ICs, 10c each.

SPECIALS

7 seg. LED Readout, NSN4, similar to Man 1, **Price 5.25 each.**

RF Power Transistor, BLY89, 25 watts out at 175 MHz., rail 13.6v., balanced emitter. **Only $9.00 each**, or two for $16.00. P/P 20c.

Transistor DC-DC converter transformer, ideal for CD ignition, 12 volts input, 320 volts at 150 bA. output. **Price 3.00 each**, P/P 20c.

TRANSISTORS

AD140	$1.00	2N3645	75c
2N3055	$2.00	2N706	45c
BC109	60c	2N3866	$1.50
BC108	50c	2N3819 FET	85c
BC107	50c	MPF121	$1.50
2N3568	75c	TIS88	$1.20

Packing and Post 10c each.

CAPACITORS—ELECTROLYTIC

1000 μF., 100 volts $1.50 ea. P/P 25c.
40000 μF., 10 volts $2.00 ea. P/P 25c

WAYNE COMMUNICATION ELECTRONICS

757 GLENFERRIE ROAD, HAWTHORN, VIC., 3122 **Phone 81-2818**

400 WATTS p.e.p. OUTPUT on SSB

with DIGITAL READOUT from 1.8 to 30 MHz.

- Designed and manufactured in Australia specifically for the Radio Amateur.
- Highest reliability and stability is achieved by quality construction, ensuring maximum performance, even under rugged mobile operations.
- MOSFETs, semiconductors and the single valve, which is fully protected by the patented tune-up system, are used to optimum advantage.
- Options: AC PS, IF Noise Blanker, Remote VFO, Mobile PS and Antennas, Transmitter Test Set.

Price: $920.00 including S.T. with Finance Available from $230.00 deposit over three years.

310-324 Ferntree Gully Road,
North Clayton, Victoria, 3168, Australia
Telephone 544-0066

A.C.I Electronics

Ionospheric Predictions

With Bruce Bathols,* VK3ASE — **NOV. '72**

Listed hereunder are the Ionospheric Predictions for November 1972, from the charts supplied by the Ionospheric Prediction Service Division.

Taking into account the predicted M.U.F. and A.L.F., these listings should provide communication between the times stated for at least 50 per cent. of the month, but not all days.

All times are G.M.T.

28 MHz.—

VK1/2	to	W6		0100
VK3	,,	JA		0300-0500
VK4	,,	5Z	L.P.	2300-0100
VK5	,,	KH6		0200-0500

21 MHz.—

VK1/2	to	8P	S.P.	2000-0600, 1100
,,	,,	8P	L.P.	2100, 1000-1600
,,	,,	VE3	S.P.	1400-1600, 1900-0100
,,	,,	VE3	L.P.	1200
,,	,,	W6		1900-0300
,,	,,	ZS		0400-1100
,,	,,	PY		2300-1000
,,	,,	G	S.P.	0700-1500
,,	,,	G	L.P.	0900-1100
VK3	,,	UA		0400-1300
,,	,,	JA		2200-1300
,,	,,	I	S.P.	0500-1200
,,	,,	I	L.P.	0800-1100
,,	,,	W1		1300-1500, 2000-2400
VK4	,,	5Z	S.P.	0600-1100, 2200-0300
,,	,,	5Z	L.P.	1900-0300, 0800-1600
,,	,,	W1		1400, 1900-2400
,,	,,	PY		2200-0600, 0900-1100
,,	,,	G	S.P.	0800-1500
,,	,,	G	L.P.	0900-1100
VK5	,,	KH6		2000-1200
VK6	,,	SU		2400-1400
,,	,,	W6		2200-0300
ZL	,,	ZS		0500-1000
,,	,,	W1		1700-2400
,,	,,	G	S.P.	0900-1400
,,	,,	G	L.P.	0800

14 MHz.—

VK1/2	to	8P	S.P.	0300-0800, 1000-1500
,,	,,	8P	L.P.	0900-2400
,,	,,	VE3	S.P.	1300-2100
,,	,,	VE3	L.P.	1300-1700, 2000-0100
,,	,,	W6		1500-2100, 0400-0900
,,	,,	ZS		1200-1600, 2000-2200
,,	,,	PY		1800-1300
,,	,,	VK6		2300-1100
,,	,,	G	S.P.	0600-1800
,,	,,	G	L.P.	0800-1400
VK3	,,	UA		0700-1600
,,	,,	JA		0500-1800, 2100-2400
,,	,,	I	S.P.	0900-0100
,,	,,	I	L.P.	0700-1600
,,	,,	W1		1300-2000
,,	,,	VK0		2000-1300
VK4	,,	5Z	S.P.	1400-2400
,,	,,	5Z	L.P.	0400, 0700-2000
,,	,,	W1		1300-2100
,,	,,	PY		0400-1300, 1800-2300
,,	,,	G	S.P.	0600-1700
,,	,,	G	L.P.	0800-1300, 2000-2300
VK5	,,	KH6		0400-1500, 1700-2100
VK6	,,	SU		1000-0100
,,	,,	W6		1600-2200, 0700
ZL	,,	ZS		0300-0700
,,	,,	W1		1300-1800, 0200
,,	,,	G	S.P.	0700-1800
,,	,,	G	L.P.	1600-2300, 0100-0500 0700-1400

7 MHz.—

VK1/2	to	W6		0800-1600
,,	,,	G	S.P.	1400-2000
,,	,,	G	L.P.	0900
VK3	,,	JA		0900-2000
,,	,,	W1		0800-1300
,,	,,	VK6		1000-2100
,,	,,	VK0		0900-1800
VK6	,,	SU		1500-2300
ZL	,,	ZS		1700

Smoothed monthly sunspot number predictions for November 54, December 51, January 51, February 45.

* 3 Connewarra Ave., Aspendale, 3195.

Magazine Index

With Syd Clark, VK3ASC

There has been a build-up in the number of magazines available this month due to a number which had been missed previously becoming available.

"BREAK-IN"

May: An RF Noise Bridge; The Experimenter's 2.5 Audio Amplifier; Three Simple ZC1 Modifications; SSB Topics with a Field Day Flavour; A Solid State Timer; Aligning the Tucker Tin Mk. II.

June: Cabinet Construction for the Amateur; Log-Periodic Antenna for 2 Metres; Simple Audio Frequency Meter; Dual Time AGC; 5/8 Wave Vertical for 2 Metres.

"RADIO COMMUNICATION"

May: Electronic Switching in Amateur Radio Equipment, Pt. 1 of three parts; Some Improvements in Digital Frequency Measurement Techniques; Speech Processing; Phased Verticals; A Cap-it-al (1) Job; The "Peg" Antennameter; Review, Heath SB303.

June: Audio Frequency Unit for RTTY Transmission; Electronic Switching, Pt. 2; More Modifications for the KW2000.

July: 144 MHz. Repeater Stations in the Amateur Service; A Transistorised Top-Band Transmitter; Electronic Switching, Pt. 3 (conclusion); A 30 MHz. IF Amp. for Microwave Receivers; A VHF Turnstile Aerial; Take to the Hills.

August: Aerial Masts and Rotation Systems, Pt. 1; Consumer Integrated Circuits in Amateur Design, Pt. 1; Equipment Reviews: Heath SB620, Yaesu YC-305 Counter, Eddystone 1000 Series Receivers.

"SHORT WAVE MAGAZINE"

April: The HW-17A Modified for Improved Performance on Two Metres; The Eddystone 888A; Transistor Transmitter for Top-Band; Miniature Monitor/Oscillator; Low Power NBFM for Seventy-cems; Tone Modulated Oscillator.

June: V-Beam as Multi-Band Aerial; JR-310 Top-Band Modification; More About the Personal Portable for Two Metres; Improving the HW-100; All-Transistor Ten-Watt Transmitter for Top-Band.

"HAM RADIO"

May: Three-Band Ground Plane; 9 Element Colinear Antenna for 2 Metres; Gamma-loop-fed Vertical Dipole; A Successful 1296 MHz. Yagi; Direct Reading and Expanded Scale SWR Meters (using surplus dual indicators); An All-Band Phased-Vertical Antenna System; Small Loop Antennas; An Antenna Coupler for the Three-Band Beam; Loading the Mobile Transmitter; Measuring Co-axial Line Loss with a Reflectometer.

"CQ"

June: "What's Past is Prologue"; A Modern 2-Tube DX Receiver to meet 1931s Strict Operating Standards; A High Selectivity I.F. Filter; Tips for Working DX; Noise and Noise Generators, Pt. 2; Getting Ready for the Oscar-6 Satellite; Adriati Islands Expedition.

August: Increasing the Operating Capability of the Heathkit SSB Transceivers; The System (Candler's Morse System); Heath Triggered Oscilloscopes (Review); Adjusting and Cleaning Speed Keys; Testing Unknown Zener Diodes, Toroid Characteristics (Note: 88 mH. loading coils are commonly used by the Australian Post Office but they are now wound on pot cores. Ed.) Slow Scan TV.

"73"

January: RTTY Art Made Easy; The TT-63A as a Display Generator; Television Monitor; AFSK Revisited; Tuning Indicators for SSTV Monitors; Designing Diode Matrix Units; The Makings of a Modern Day Receiver; Simultaneous Multiband Transmissions; A Pre-Novice Transmitter; The Problem of Inversions; An MF Converter for HF Receivers; Easy End Feed Z-Match; Coat-hanger Ant. for 2 Metres.

June: Six Elements on Twenty Metres; Slow Scan Television; Beaming the Vertical Antenna; Active Filter Design and Use, Pt. 1; Antenna Party; Radio Astronomy and Amateur Radio; Patenting Your Invention; 20 dB. Beams; Phasing Multiband Vertical Antennas; Ham TV: A Public Service; The Modified Suction Cup Antenna; 300 MHz. Frequency Scaler; Elliptic Function Filters for RTTY; Trouble Shooting for the Novice; Improved Low-Cost CD Ignition, Lightning.

"QST"

May: Some Practical Aspects of VXO Design; A Frequency Calibrator for UHF Using an Avalanche Transistor; Increased Power for the Solid-State Transmitter; Conversion of Telefax Transceivers to Amateur Service; A Co-axial Line Amplifier for 220 MHz.; By the Light of a Diode; An Inexpensive Secondary Frequency Standard; Some Two Metre Solid-State RF Power Amp. Circuits; Adding Letter and Word Spacing to ICKEY; A Strip-Line Kilowatt Amplifier for 432 MHz.; Review Bird Ham-Mate Directional Wattmeters.

July: The Flashlight Sidebander; The Dit-Ditter; A Two Metre Pre-Amplifier for Repeaters; Improving CW Reception on the SB-303; A Home Made Duplexer for 2 Metre Repeaters; A Study of the DDRR Antenna; A "Stretcher" for End-Fed Multiband Wires; A Storage-Tube Monitor for SSTV; A Pip-Squeak Follower for 220 MHz.; D-Layer Absorption during a Solar Eclipse; Review: KW-107 Supermatch, Heath SB-610 Monitorscope; The Ailing Emporium; 220—What is it good for?; Amateur Radio—Privilege and Responsibility.

KEY SECTION

With Deane Blackman,* VK3TX

The personal problems of column editors should not of course enter into their column. However, I have on return from overseas, moved for a time to Sydney. In all that my system for compiling these notes has gone awry, so light on this month. I even missed the opportunity to tell you about VK2BQQ operating from Lord Howe—last month! My thanks to VK4PJ for the information, and if anyone hears of similar forthcoming events which promise plenty of c.w. (as this one did) I'd be happy to hear about them.

Listening to one of the slow morse transmissions on 3550 kHz. put out by the hard-working and public-spirited group up here in VK2 set me wondering what others do. I have listened to this from my home QTH on occasions, but 80 metres is not always kind even there, and must be very hard for someone insecure at receiving. What sort of copy do other States make of these, or do you rely on the tape service? Would some newly-licensed chap like to tell me what more could be done to make easier or more convenient the mastery of what most seem to think the most difficult part of getting on the air.

[Apologies for incorrect address given in October "A.R."—Ed.]

* P.O. Box 382, Clayton, Vic., 3168.

NEW POSTAL ADDRESS FOR
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"20 YEARS AGO"

With Ron Fisher, VK3OM

"I was televised in 1952". Last month in these notes mention was made of the All Models Exhibition held at the Melbourne Exhibition buildings. Twenty years later, the November 1952 editorial of "Amateur Radio" is worth quoting. "Twenty years from now—maybe less, maybe more—thousands of people can cast their minds back to a crowded, noisy, echoing building. At this time, when television will be as commonplace as ordinary amplitude modulated broadcasting is today, these same people will be telling their children and grand children, 'I was televised in 1952'." This was unique in that the equipment with which they were televised was Amateur equipment; the first known Amateur television equipment in Australia. It was completely home-built and installed at the Exhibition by Len Moncur, VK3LN.

V.h.f. conditions must have been really hot during the month of October. According to the V.h.f. Notes, VK3RR was heard in ZL. At the time, a two mx contact did not take place, but VK3RR was logged by ZL3AQ at 0807 GMT on 2nd October at R5, S5 to 6.

The 1952 R.D. Contest results headline the news that "Western Australia does it". Tasmania, who held the lead for the previous three years, slipped to third place with Queensland coming in second. Top individual scorers in each State were: VK6RU 728, VK4CB 784, VK7KB 734, VK2AHA 725, VK3JE 568, VK5FO 557 and VK9GW 630. These scores probably seem low by today's standards, but it was still hard work.

Technical articles for November included a gem. J. M. Coulter, VK5JD, wrote about "Odds and Ends". His opening paragraph is self explanatory. "Many Amateurs are unaware that a number of articles, designed primarily for other trades, are very easily adapted to their hobby". We need some one to write an up-to-date version of this now.

C. D. L. Tilbrook described "A Unique Crystal Converter for 50 and 144 Mc." The circuit used a 6J6 as a push-pull neutralised r.f. stage to a 6J6 push-push mixer, with a 6AC7 oscillator and 6J6 multiplier. Veteran "A.R." author, C. A. Cullinan, then VK7XW, described his "Crystal Marker for Amateur Receivers" and Vaughan Wilson, VK2VW, showed us how to build a simple 80 metre transmitter. The line up was a 6V6 operating either as a crystal oscillator or buffer from an external v.f.o., driving a pair of 807s in the final.

"CW Ratings of some Receiving Type Tubes"—C. A. Cullinan again—and this time Chris presented a handy chart showing the transmit ratings of a group of common receiving tubes.

SILENT KEY

It is with deep regret that we record the passing of—

VK2WH—W. H. R. Stitt.

Letters to the Editor

Any opinion expressed under this heading is the individual opinion of the writer and does not necessarily coincide with that of the Publishers.

Editor "A.R.," Dear Sir,

May I respectfully make a few comments on "A.R." Firstly, the Newcomer's Notebook is a good idea—the more simple and fundamental type articles the better.

I am sorry you appear to no longer print call signs discontinued or transferred. This is greatly missed and would request resumption.

In the Call Book could the type be set so that all names are under each other in line? Could the suburbs or towns be put in line for easy reference? As the current book is soon out of date, could a supplement be printed of new calls, say each six months?

Many of us have friends studying for the A.O.C.P. examn. Why not print the latest theory papers in "A.R." The standard of the exam. is always a talking point among Amateurs—I think this would be appreciated.

With very best wishes, 73,

—E. L. Ross, VK3YEL.

[It is intended to resume publishing alterations and cancelled call signs immediately after the closing date for amendments for the 1973 Call Book, viz. 31st December, 1972. The costs of setting the names and towns in line under each other in the Call Book are prohibitive at the present time. The suggestion of printing the A.O.C.P. theory papers immediately after each examination is excellent, and the August 1972 A.O.C.P. examination paper appears on page 18 of this issue.—Ed.]

INTRUDER WATCH

With Alf Chandler, VK3LC

It may be co-incidence, but it seems significant that the following Intruders have not been heard in our bands recently after being reported by Intruder Watch Observers, both in Australia and in the U.S.A. They are:—

TCX—Turkey, point to point r.t.t.y. carrying British Embassy traffic.

YBU—Cuba. Apparently moved by U.S. reports, but reported here too.

HGX37—Czech Embassy station.

If we can get the Indonesian stations 7BD2, 7BD4, 7BQ2, 7BZ2 out of the 14 MHz. band, that would be something to crow about.

I'm trying hard enough but need more reports, the more the merrier. Also reports on information on traffic carried by the r.t.t.y. station KJG is required by the U.S. It's an F1 r.t.t.y. on 21104-7 kHz. and heard out here around 1000 GMT.

HAMADS

- A free service for individual members.
- Four lines of print free (200 characters/spaces); full charge at $6 (min.) per col. inch if exceeded or for repeats; includes name/address—use QTHR if correct in Call Book.
- Copy, please in typescript if possible, and signed.
- Excludes commercial-class advertising.
- Exceptions only by PRIOR arrangement.

For full details see January 1972 "A.R.." page 23.

FOR SALE

Mildura, Vic.: Hallicrafters HT32 transmitter and SX111 receiver, good condition with handbooks. 40 mx SSB home-brew transceiver with matching power supply. 6 ft. cabinet rack, including linear amp. (80, 40, 20, 2/805) and heavy duty power supplies. 50 ft. winch-up tower and guys. 3 el. 20 mx Yagi. Prices, details, VK3AGF, QTHR, Ph. (050) Bus. 23-4028, A.H. 23-2981.

Dural, N.S.W.: Telescopic 45 ft. tilt-over Tower, good condx., complete, $50. Also 95w. 2 mx AM Tx, has wkd. ZLs, complete with mod. and P.S.U., $30. VK2ZZI, QTHR, Ph. (02) 651-1425.

Girraween, N.S.W.: Trio TS-510 5-band 200 watt Transceiver, complete with noise blanker, external VFO, AC P.S.U. and DC-DC mobile supply. Ex. cond. $480 o.n.o. VK2AZY, 15 Mandoon Rd., Ph. (02) 631-7453.

Melbourne, Vic.: 4-pole 5.2 MHz. Filter, complete with USB/LSB carrier xtals, $15. VK3ARZ, QTHR, Ph. (03) 232-9492.

Sydney, N.S.W.: 6 metre: MR20A $35, Pye Reporter, tuneable, $15, Vinten MTR12T $30; T.C.A. 1674 2 mx $30. VK2ZZX, Ph. (02) 399-9392.

Reservoir, Vic.: Complete AM/CW station; Eddystone 888A, Geloso 222, G5RV, mike, etc. Very good condition, $225. Returning W-land Nov. VK3BGF, 162 Spring Street.

Melbourne, Vic.: Electronics Aust. SSB Xmtr. and 700v. power supply. Very neat, was all new parts, suit beginner, $60. VK3AJP, QTHR, Ph. (03) 288-1842.

Melbourne, Vic.: Geloso G4/225 SSB-CW Tx, 80 to 10 mx, 160-200w. PEP, pair 6146s in final, complete with companion PSU, $345.00; Geloso Nuvistor Converter for 144-148 MHz. and 431-436 MHz., complete with PSU, output 26-30 MHz., $35. Eddystone 770R VHF Rx, 19 to 165 MHz. in six ranges, working well, $480.00. Bob Cunningham, VK3ML, QTHR, Ph. (03) 329-9633.

Toukley, N.S.W.: Complete ATV Station. Tx, 60w., transistorised camera, sub carrier generator and monitor, 435 MHz. Or Exchange for SST equipment. P.O.A. VK2AJY/T, QTHR.

Melbourne, Vic.: Swap Mobile Power Supply, suit Swan, Galaxy, FT200, etc., for Vertical Antenna (18AVQ or sim.), or sell $45. VK3AQK, QTHR, Phone 57-1107.

Asquith, N.S.W.: 1 inch Vidicon Camera Tubes, 2nds, $15. Transistor Vidicon Deflection Yoke, new, $15. 5UP1(F) CRT, new, $4. Vidicons suitable for SSTV. VK2ZPM, QTHR, Ph. (02) 476-2304.

WANTED

Sydney, N.S.W.: Circuit and alignment data for AR88LF Receiver. VK2ZJF, QTHR, Ph. (02) 969-4539.

Balmoral, Qld.: Padder Condenser up to 500 pF., 200 pF. variation okay (Drake 2B modif.). VK4PJ, QTHR.

Mount Isa, Qld.: Commercial 12v. DC PSU, suit mobile operation of Swan 350. Must be A1 condition. Price/details to VK4OV, QTHR.

Sydney, N.S.W.: FT200 w/w.out PS, must be reasonably priced and in good order. Price and details VK2ABC, QTHR, Ph. (02) 451-1313.

Melbourne, Vic.: Collins Mechanical Filter (plus data), with or without crystals. R. J. Hoffmann, 4 Owen St., East Kew. Ph. (03) 80-1858.

Sydney, N.S.W.: Panadaptor or similar device. Details R. Graham, VK2ZQJ, QTHR, Ph. (work) (02) 642-0122.

Brisbane, Qld.: Transistorised 2 mx Transceiver, multi-channel, 25 watts, 12v. DC. G. Lee-Manwar, VK4ZML, 44 Webb St., Stafford, Brisbane, 4053.